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**AN EVALUATION
OF THE
DEGEM CAI PROJECT
ONCHAMINAHOS AND KEHEWIN SCHOOLS**

MACROSCH EDUCATIONAL CONSULTING SERVICES INC.

UNDER CONTRACT TO

**ALBERTA EDUCATION
EDMONTON, ALBERTA**

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Please Note:

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ABSTRACT

The primary intent of this study was to explore the effect of a Computer Assisted Instruction (CAI) system on student learning and achievement. The CAI system under study is an integrated learning system known as DEGEM. The system consists of a 40 megabyte miniframe computer and 24 terminals with detachable keyboards. This system was studied in two Canadian Native schools in Northeastern Alberta. Students from grades two through eight participated in the longitudinal study, which involved the collection of both quantitative and qualitative data from both sites.

Eight research questions were posed, two requiring quantitative data, involved exploring student achievement and thinking skills. Questions regarding the diagnostic capabilities of the system and its application to special needs students were explored using a case study format. The area of the suitability and reliability of the hardware and software was also explored. Qualitative data was used to examine the need for teacher inservice necessary to use the systems, as well as to explore student, parent, teacher, and administrator perceptions of the system. Finally, student time on task was examined while on the system and in the classroom. Each question was examined in detail, data were presented, and a brief discussion ensued.

There were a number of problems in applying the original study design which was supplied to the researchers. Attempts were made to minimize any threats to validity. Unfortunately, due to a number of difficulties experienced at both sites very little quantitative data was available from which to develop conclusions or make recommendations. For the most part the qualitative data was intact and yielded some insights into the DEGEM system. These areas of difficulty are discussed in some detail in an attempt to assist and guide future researchers.

The study concludes with several recommendations including the need for a very knowledgeable systems manager, the need for ongoing and intensive inservice, and the need for further study of the system's diagnostic capabilities. The Curriculum Support Branch's appraisal of the DEGEM system concludes with a recommendation that the system is not suitable for general use in Alberta.

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TABLE OF CONTENTS

CHAPTER ONE - INTRODUCTION.....	1
CHAPTER TWO - RESULTS AND DISCUSSION.....	7
Question One - Student Achievement	7
Discussion - Question One	13
Question Two - Courseware Appropriateness	15
Question Three - Diagnostic Capabilities	16
Discussion - Question Three	27
Question Four - Inservice	34
Discussion - Question Four	39
Question Five - Thinking Skills	41
Discussion - Question Five	46
Question Six - Teacher Perceptions	47
Discussion - Question Six	64
Question Seven - Student Perceptions	66
Discussion - Question Seven	75
Question Eight - Hardware/Software	77
Discussion - Question Eight	83
Question Nine - Special Needs Application	89
Discussion - Question Nine	86
CHAPTER THREE - SUMMARY AND RECOMMENDATIONS	91
Summary	91
Recommendations	95
REFERENCES	97
APPENDIX A	98
APPENDIX B	148
APPENDIX C	179

LIST OF TABLES

Table 1	Mean Achievement Scores by Grade.....	8
Table 2	Mean Values - Student Achievement - Teacher Questionnaire ..	13
Table 3	C.J.'s Canadian Achievement Test Results	18
Table 4	R.G.'s Canadian Achievement Test Results	22
Table 5	C.G.'s Canadian Achievement Test Results	24
Table 6	Mean Values - Inservice - Teacher Questionnaire	37
Table 7	Mean Scores Test of Cognitive Skills By Grade	42
Table 8	Correlations Achievement By Cognitive Skills	44
Table 9	Mean Values - Thinking Skills - Teacher Questionnaire.....	45
Table 10	Mean Values - General Application - Teacher Questionnaire....	54
Table 11	Familiarity With Computers Versus The Value of DEGEM.....	63
Table 12	Mean Values - Student Questionnaire.....	68
Table 13	Time On Task.....	75
Table 14	Mean Values - Hardware/Software - Teacher Questionnaire....	80
Table 15	Original Cost Of The DEGEM System	81
Table 16	J.L.'s Canadian Achievement Test Results	87

CHAPTER 1 - INTRODUCTION

The DEGEM system is an integrated learning system distributed by Innovative Technologies in Education Inc. In both Onchaminahos and Kehewin schools, the system consists of a 40 megabyte miniframe computer with a 20 megabyte tape back up, 24 terminals with detachable keyboards, one printer, TOAM 2A courseware and additional software for systems management and authoring. At Onchaminahos School the system is referred to as "DEGEM", while at Kehewin School, the system is referred to as "TOAM". To avoid confusion throughout this report, the system will be referred to as DEGEM.

The TOAM 2A courseware, developed in Israel, provides basic skill and drill exercises in mathematics for grades one through eight inclusive, and in language arts for grades two through seven inclusive (DEGEM, 1987). In addition, the system has extensive recordkeeping functions which enable the user to obtain a number of diagnostic printouts, by class, for either language arts or mathematics. The printout, through a variety of symbolic codes, enables the teacher to track any given student's progress throughout the course.

The system at Kehewin School was installed in the fall of 1986. Students in grades two through nine were involved in regularly using the system, until June 1988 primarily for mathematics, although some classes used it for language arts as well. A few classes were involved in other activities such as typing. In the 1988-1989 school year there were a number of changes at the school which impacted the use of the system. There were two administrative changes (September 1988; January 1989); two systems manager changes (September 1988; February 1989); and almost half the teachers who were there in June 1988 were not there in September 1988. As a result, in 1988-89 it appears that the DEGEM system was used sporadically until the January - February time frame.

At Onchaminahos School, the system was installed in January 1988. Students from that time until June 1989 used the system regularly. Grades K through nine used the system for mathematics, language arts, and other activities. The systems manager at Onchaminahos resigned in June 1989. At that time it was requested that he shut the system down and lock the drives, as one would do to prepare to ship the computer system. Apparently, at this time there are no plans to use the system for the 1989-1990 school year.

The computer systems were purchased to provide assistance to the students in both schools to enhance their academic skills in language arts and mathematics. Gittinger (1986) indicates that the DEGEM courseware was developed to provide, "a well sequenced instructional support system in language and mathematics . . . [for] culturally diverse immigrants. . . . the program was intended to have its greatest impact in rural areas suffering from teacher turnover and relative deprivation due to isolation." (p. 2). Students involved in the present study are not immigrants; they are, however, part of a Native culture and are in schools which are relatively isolated. Ramage (1987) indicates that DEGEM has been used successfully in a small isolated school district in Texas. Additional literature has been reviewed, some of which appears to have been written "in house", (i.e., by DEGEM staff, evaluating the system); other literature has been published in several different journals. It does not appear, however, that a comprehensive literature review has been conducted with respect to the DEGEM system, and although it falls outside the scope of this report, the results of such a review provide additional insight into the effectiveness of the DEGEM system.

This final report is divided into three major sections: introduction; results and discussion; and summary and recommendations. The results and discussion section is further divided into eight components, identified by each research question. Eight questions (numbers 1, 3-9) and the basic research design were given to MacRosch Educational Consulting Services Inc. by Alberta Education. One question, question two, was to be answered by Alberta Education. The findings can be found in Appendix C. There were some initial concerns raised by MacRosch as to whether the design would allow for the collection of data necessary to accurately answer some of the questions posed. For example, the heart of the study required the measurement of gains that students made in either language arts or mathematics when using the DEGEM system. A control group was part of the

initial design; however, the "control group" specified by the design also used the DEGEM system, just in another subject area. This design was based on the assumption that using the system would not generalize across subject areas; however, there would be no way of ascertaining whether or not this would be the case as there was no "control group" who did not use the DEGEM system at all. Another weakness in this area was that because of the size of the student enrolment, the design required that the control group for the grade four group, for example, was the grade five group. These types of threats to the internal validity to the study were inherent in the original design. It was decided by the Steering Committee, that given the available sample, the project should proceed as tendered.

The primary intent of this study is to determine whether using the DEGEM system in combination with regular classroom instruction enhances student learning in mathematics and language arts over regular classroom instruction alone. It appears that most of the studies conducted to date regarding student achievement have been coordinated by DEGEM staff and have been conducted over periods ranging from two weeks to several months. At this time it does not appear that any studies one or more years in length have been conducted.

This next section describes both the qualitative and quantitative data collected. Results are reported for each question given in the original design, beginning with question one. The results of Alberta Education's findings for question two, dealing with the appropriateness of the courseware relative to Alberta Education Clearinghouse criteria and standards, are reported as given to MacRosch in Appendix C. The questions with respect to whether DEGEM CAI instruction results in improvements in student achievement (question one), and thinking skills (question five), combine qualitative and quantitative data. The DEGEM diagnostics compared to the CAT diagnostics (question three), and use in a special education context (question nine), are presented in a case study format. This format yields the most information given the design and contextual limitations which will be discussed later. The data reported in the area of inservice training (question four), are presented for the 1987-1988 school year only, as no inservice was conducted during the subsequent academic year. The teacher and administrator perceptions (question six), and student perceptions (question seven), are exclusively qualitative and derived from responses to questionnaires and structured interviews. The cost

effectiveness and system reliability (question eight) data were gathered from several sources and will be reported as collected.

Questionnaires were distributed to teachers, students, administrators, and systems managers. The results arising from the questionnaires are reported in the same manner across groups. Respondents were asked questions and selected their responses from a five-point rating scale: 0 = strongly disagree; 1 = disagree; 2 = neutral; 3 = agree; 4 = strongly agree.

The original design called for a qualitative assessment of DEGEM at both sites. The information was to be gathered from teachers, students, systems managers, parents, and administration. This was done in 1988. Questionnaires were distributed to students in both schools, Onchaminahos grades 2 through 6 inclusive; Kehewin grades 2 through 7 inclusive. All teachers who taught the same grades as the students surveyed, were given questionnaires. The systems manager from each school was given a questionnaire as were the administrators (3 at Onchaminahos and 1 at Kehewin). Face to face interviews were conducted with a select sample of parents, a random sample of students, and all teachers, systems managers, and administrators. In 1989 the Steering Committee decided that, because of community sensitivity, the parent group would not be interviewed again, and that the questionnaires given to the systems managers, teachers, and administrators would be replaced by the teacher questionnaire, which would be given to all groups. The teacher questionnaire was modified, in that all references to inservice were deleted, as no inservice had been conducted between May 1988 and June 1989. All teachers again were invited to participate in a face to face interview. No face to face interviews were to be conducted with students unless some unusual findings were to arise out of the second round of questionnaires.

With respect to participation in the qualitative portion of this study, in 1988, eight teachers from Kehewin School and nine teachers from Onchaminahos School wrote comments on the questionnaires. In the same year, 89 students from Kehewin and 109 students from Onchaminahos responded to the comments section of their questionnaire. Face to face interviews were conducted with eight teachers from Kehewin and nine teachers from Onchaminahos. In addition, interviews were conducted with 33 students from both Kehewin and Onchaminahos. A total of seven parents were interviewed from both schools combined. In 1989, nine

teachers from Onchaminahos returned the answer sheet to the questionnaire; however, no written comments were submitted. At Kehewin two teachers returned the answer sheet; however, one was incomplete, resulting in insufficient data to be considered representative of the perceptions of the Kehewin staff. It should also be noted that given the very high staff turnover in the school, the results from the first round of data collection to the second would not have been comparable, even if all the Kehewin teachers had completed the questionnaire. In 1989, 87 students at Kehewin completed questionnaires while ninety-five students at Onchaminahos also completed questionnaires. In 1989, the systems managers and administrators completed the teacher questionnaire rather than their own specific questionnaire as they did in 1988. Also in 1989 no parent interviews were conducted nor were any interviews with students conducted; however, 8 teachers were interviewed at Onchaminahos and 9 teachers were interviewed at Kehewin.

One serious problem arose during the course of collecting the quantitative data. The data collected at Onchaminahos were contaminated during the second round, primarily due to the fact that the student cohort groups were mixed. An example of how serious the contamination was will be given for the first two grades which comprised the study. In 1988 the original design called for one class of grade 2's (2A), to use the DEGEM system exclusively for mathematics and the grade 2B class to use the system exclusively for English. As this group moved to grade three, the 3A class was to remain on mathematics and the 3B class on English. In 1988, 18 students were in 2A and 18 students were in 2B, for a total of 36 students. In 1989, there were 12 students in each of 2A and 2B, for a total of 24 students. When the common students are abstracted from the two groups there were a total of 16 students who were common (9 in mathematics and 7 in English). All other students were in these classes for only one year or the other. When the students are tracked more carefully it will be found that of the eighteen students who started in mathematics, by grade three, seven of them had been moved to the English class and were subsequently lost to the study. Of the 18 students who started in English, five had been moved to mathematics. The net result is, of the 36 students who began the study in grade 2, four useable subjects remained in English and four useable subjects remained in mathematics. These numbers could be further reduced if any of these eight students did not complete the total CAT or TCS battery. With respect to the movement of students from one group to the other, it

was understood by the school administration at the outset that student needs would take precedence over the study design.

In 1988 the grade three class, there were originally 38 students divided between mathematics and English. In 1989 these two classes were combined into one grade four class. This combined class used the system exclusively for English; therefore, all the mathematics subjects were lost. Late in the 1988-1989 school year this class was split into two classes. Unfortunately, when the class was split, the students were not divided such that they used the system for the same subjects as they did in 1988 (i.e., some of the English students were placed in the mathematics section). When the common students over two years are abstracted and the numbers are adjusted for who switched subjects on the system, there are no useable subjects remaining in the current grade four class.

These two groups were the backbone of the study. When they were lost it limited the utility of the quantitative data in part two. As well, problems with decreasing numbers and incomplete data were evident in the remaining grade levels, rendering the data inconclusive, at best.

CHAPTER 2 - RESULTS AND DISCUSSION

QUESTION ONE - *Does the use of DEGEM CAI result in improvements in student achievement in reading and mathematics relative to conventional instruction? What measured gains in reading and math occurred?*

As was indicated in the original design, the quantitative results required to answer this question were to be gathered from Onchaminahos School in Saddle Lake. The instrument used to gather the data was the Canadian Achievement Test (CAT). As this test was not being used in either school (Onchaminahos or Kehewin) prior to the study, an inservice was conducted with each staff. Generally the inservice covered topics such as how to administer a standardized test, the strengths and weaknesses of the CAT, and the purpose of the testing. The administration of the CAT was conducted by the classroom teacher during a ten-day interval in May 1988, and subsequently in early June 1989. The results were collected and scored. The numbers reported at each grade level indicate the total number of students who wrote the CAT. Unfortunately, in many cases there were missing data (i.e., the child only wrote parts of the CAT); therefore, the actual records read for any one subtest could vary considerably.

The 1988 results comparing Grade 2A with Grade 2B, Grade 3A with Grade 3B, Grade 4 with Grade 5, and Grade 5 with Grade 6 are reported in Table 1. The Grade 7 class was not included in this study as they were not using the DEGEM system in 1988. The results reported are based on the average raw scores for each class on five measures; total reading, spelling, total language, total mathematics, and total battery.

Table 1

Mean Achievement Scores on the Canadian Achievement Test Reported By Grade

Grade 2A (Mathematics) By Grade 2B (Language)

Area	Means		Standard Dev.		T	Prob.2-Tail
	2A	2B	2A	2B		
Reading	58.1	39.5	9.9	12.6	4.7	0.00
Spelling	15.5	12.2	3.5	2.7	3.1	0.00
Language	31.3	22.4	5.0	5.4	4.8	0.00
Mathematics	52.8	39.3	8.6	11.1	3.8	0.00
TOTAL	161.6	113.4	16.2	28.0	5.7	0.00

Grade 3A (Mathematics) By Grade 3B (Language)

Area	Means		Standard Dev.		T	Prob. 2-Tail
	3A	3B	3A	3B		
Reading	32.9	44.0	11.4	12.0	-2.6	0.01
Spelling	12.6	12.2	3.5	3.8	0.0	0.97
Language	23.1	23.9	5.1	6.3	-0.4	0.68
Mathematics	41.4	45.5	13.8	13.6	-0.9	0.40
TOTAL	107.9	125.2	27.3	30.2	-1.6	0.13

Grade 4 (Mathematics) By Grade 5 (Language)

Area	Means		Standard Dev.		T	Prob. 2-Tail
	4	5	4	5		
Reading	28.6	30.3	9.4	11.3	-0.5	0.62
Spelling	12.2	12.9	4.2	3.9	-0.6	0.56
Language	29.5	29.6	8.6	10.6	-0.0	0.99
Mathematics	35.8	34.5	10.5	12.7	0.4	0.73
TOTAL	107.2	106.1	26.5	29.5	0.1	0.90

Table 1 Continued

Mean Achievement Scores on the Canadian Achievement Test Reported By Grade

Grade 5 (Mathematics) By Grade 6 (Language)

Area	Means		Standard Dev.		T	Prob. 2-Tail
	5	6	5	6		
Reading	30.3	31.9	11.3	10.0	-0.5	0.64
Spelling	12.9	14.8	3.9	3.0	-1.6	0.12
Language	29.6	33.8	10.6	9.1	-1.3	0.21
Mathematics	34.5	55.6	12.7	14.0	-4.8	0.00
TOTAL	106.1	136.5	29.5	31.9	-2.9	0.01

Grade 2A ($n=18$) used the DEGEM system for mathematics only, while the Grade 2B ($n=18$) class used the system for language arts only. As can be seen, the 2A class is significantly stronger than the 2B class in all areas regardless of the subject for which the students were receiving CAI.

The Grade 3A ($n=22$) class used the DEGEM system for mathematics only, while the Grade 3B ($n=16$) class used the system for language arts only. As can be observed, there is a significant difference in favor of the 3B group on the total language score. It should be noted that this group also tends to be stronger than the other on all measures, although the differences are not significant.

The results of the Grade 4 ($n=22$) class, which only used the system for mathematics, were compared to the results of the Grade 5 ($n=19$) class, which only used the system for language arts. No significant differences were noted. The Grade 5 group tended to be slightly stronger on the total reading and spelling, while the Grade 4 group tended to show strengths on the total mathematics and on the total battery.

The results from the Grade 5 class ($n=19$), a class which only used the system for language arts, were compared to the Grade 6 class results ($n=19$), a class which

only used the system for mathematics. A significant difference is reported for the Grade 6 class on the total mathematics and on the total battery. The same class showed itself to be stronger in all other areas although these results were not significant.

Qualitative data regarding student achievement were collected from teachers at both sites by using a questionnaire and a structured interview. In 1988 a total of eight teachers from Kehewin responded, while a total of nine teachers from Onchaminahos responded. For any given item, however, usually about fourteen of the possible seventeen teachers would respond. Occasionally the number responding was as low as eleven or as high as sixteen. These figures hold for any data reported from the questionnaire. The actual numerical values of the questions for this section are reported in Table 2. In 1989 nine teachers from Onchaminahos and two teachers from Kehewin responded to the questionnaire. Further, in 1988-89 a selected group of parents (i.e., had a child using DEGEM and was part of the support staff at the school) were invited to participate in a face-to-face interview to report on the effect of DEGEM on their children. These results will be reported at the end of this section.

In 1988, on the student achievement portion of the questionnaire, thirteen teachers responded to questions regarding mathematics and eight teachers responded to questions regarding language arts. It should be noted that at Onchaminahos School classes use DEGEM for either mathematics or language arts, and at Kehewin almost all staff used it for mathematics and fewer used it for language arts. When asked whether DEGEM contributed to the improvement in basic arithmetic skills (1988), both groups agreed, with Kehewin being more affirming; however, in 1989 the Onchaminahos teachers showed much stronger agreement for the positive effect in arithmetic than did either group in 1988. With respect to problem solving skills, again there was general agreement, although the Onchaminahos teachers were less positive in 1989. When asked about improvement on various dimensions of language arts skills, both groups responded in the *neutral* to *agree* range. The sole exception was in vocabulary skills where the responses were in the *neutral* to *disagree* range. In 1989, there was a general down turn in the Onchaminahos teachers' responses in all areas dealing with language arts and DEGEM's effectiveness. Although all scores remained in the neutral to agree range, there was a major drop in teachers' perceptions in the area of reading fluency. In 1988, the

administrators indicated they had noticed an overall improvement in basic arithmetic and language arts skills since the arrival of DEGEM.

The results of the open-ended questions indicated (1988) that teachers believed that DEGEM had contributed the most to their students' progress by providing them with drill and practice in a variety of areas. Some teachers indicated that the ten-minute time limit tended to keep students more on task. When asked for one way to improve the system the answers were diverse but interesting. One teacher suggested that similar worksheet activities be made available. Other comments were: "Improve the re-inforcement provided to the students for correct answers"; "Have one terminal to monitor student progress"; "Have the computer provide hints as students begin to have problems"; "Match the computer grade levels to Alberta grade levels, the present ones don't correspond"; "Give the students more personal feedback (reinforcement)".

In 1988, the Steering Committee believed that the impressions of the community could add valuable information to the data base. Initially, it was decided to survey a representative sample of parents in both communities; however, after meeting with the Steering Committee and discussing the concept, it was decided that, in order to respect community sensitivities, a survey of a smaller purposive sample would be more appropriate at this time. Therefore, it was decided that in order to participate in the survey, a parent must have a child in the school using DEGEM, and the parent must be part of the paraprofessional support staff at the school. It should be noted that this group of individuals would not likely be representative of the community at large, as they would have a more informed perception than a randomly selected group would have. The systems manager in each school arranged a number of interviews with parents in his own school. Originally, thirteen parent interviews were to be conducted; however, with the difficulties in scheduling, and absenteeism on the date of the interviews, the final sample size was seven: four at Onchaminahos; and three at Kehewin. A face-to-face structured interview was conducted with each parent. The seven parents represented seventeen children in attendance in either school. The first question asked dealt with awareness. All parents indicated that they were aware that the DEGEM system was being used in their school. One parent indicated, however, that it would be unlikely he would have known of the system had he not been working in the school.

Parents were then asked if their children talked about DEGEM at home. Four of the seven parents responded in the affirmative. One-half of those responding indicated that their children "talked a lot" about the system. Most of the comments made about the system at home are positive in nature (e.g., "I like it"; "It helps me learn a lot."). Only two parents indicated that any of their children made any negative comments at home.

When asked whether they thought there was any attitude change in their children since using the system, three parents responded affirmatively. (e.g., "They look forward to school and the computer"; "They seem to know a lot more."). One of the parents who had seen a positive change in his children indicated that this may not be a consequence of using the computer. Four parents saw no change in attitude. Regarding whether they noticed any change in marks, four parents noticed a change, especially in reading comprehension, mathematics, and spelling. One parent saw no change, and two parents said it was difficult to determine whether the changes could be attributed to DEGEM.

When asked to rate the impact of the system on their children, all responded positively. As well, all indicated that they would like to have an opportunity to use the computer themselves. In fact, some were already doing so. A sampling of general comments follows - "Not enough material - sort of limited"; "Parents should use it"; "Makes kids lazier"; "Great having a computer in the school"; "Access/feedback right away"; "Gave students a better understanding".

Table 2

Mean Values of Student Achievement Questions - Teacher Questionnaire

	1988		1989
	Keh	Onc	Onc
12. The DEGEM system has contributed to my students' overall basic arithmetic skills.	3.2	2.9	4.3
13. The DEGEM system has contributed to my students' overall problem solving skills.	3.2	2.9	2.4
14. The DEGEM system has contributed to my students' overall reading comprehension skills.	3.1	2.8	2.7
15. The DEGEM system has contributed to my students' overall vocabulary skills.	3.1	2.8	2.6
16. The DEGEM system has contributed to my students' overall decoding skills.	3.6	3.3	2.7
17. The DEGEM system has contributed to my students' overall reading fluency.	3.5	3.0	2.1
18. The DEGEM system has contributed to my students' overall grammar skills.	3.5	3.1	2.9
19. The DEGEM system has contributed to my students' overall punctuation skills.	3.6	3.1	3.1
20. The DEGEM system has contributed to my students' overall spelling skills.	3.1	2.9	2.4

DISCUSSION: QUESTION ONE

The primary site for the quantitative data collection was Onchaminahos School; qualitative data was collected from both sites. In 1988 the teachers at both schools perceived DEGEM to have assisted in the area of student achievement with more effect seen in the mathematics area. The administrators were generally in agreement with the teaching staff although they perceived the system as having a greater effect than did the teachers. There was a general drop in perceived effectiveness of the

DEGEM system in language arts at Onchaminahos in 1989. There was, however, an equally large rise in the perceived effectiveness in the arithmetic area by the same group. The quantitative data that were collected and examined did not allow for any conclusions to be drawn. However, two general statements can be made. First, in 1988, the distribution of the students in their classes may not have been random, in the statistical sense; the students in the classes may not have been divided equally according to ability; however, it is apparent that some classes are much stronger as a group (e.g., Grade 2A; Grade 6). The total impact of this variation is unknown. For example, if the more able students (or the less able students) derive greater benefit from DEGEM there would be an unequal weighting on the final result which could lead to erroneous conclusions. Second, the design assumes that the gain in instruction will be limited to the subject to which the students are assigned. For example, it is assumed that if a student only uses the computer for mathematics that this will have no effect on his language arts. This appears to have face validity; however, it would have been better to match the class receiving CAI in mathematics to a class receiving classroom instruction alone; however, this was not possible given the initial low student numbers. There is an unknown factor introduced by having all students participate in CAI for one subject or the other. These two factors may have some impact on the data; however, the degree of impact will remain unknown. At this point, with the useable data collected (1988-1989), no significant differences between groups can be attributed to CAI on the DEGEM system. Parent interviews presented a mixed reaction to the system; however, the general indication was that the parent population selected was likely more aware of the system and its strengths and weaknesses than those parents in the community at large. The teachers' reactions to the effectiveness of the DEGEM system are discussed fully in question six.

QUESTION TWO - *How appropriate is the DEGEM CAI courseware according to the Alberta Education Clearinghouse criteria and standards, including management systems, content sequence and range, and instructional format?*

The results of the study which pertain to this question, as prepared by Alberta Education, are found in Appendix C.

QUESTION THREE - *How appropriate is the DEGEM on-board diagnostic test capability compared to the standardized diagnostic tests chosen as test instruments in the present evaluation?*

These data will be reported using three case studies. For the first two, each student was selected at random from the DEGEM class lists which were sorted by urgency. That is, the system has identified these students as requiring assistance. One student was selected from language arts and one from mathematics. A diagnostic report was written for each child based on the DEGEM results. The CAT results for the same students were analyzed and a diagnostic profile was written from the perspective of the CAT information. The two reports (i.e., DEGEM and CAT) were then compared. The third student was identified as having difficulty according to the CAT results and was selected at random. The procedure outlined above to analyze the results was reversed. Copies of the DEGEM printouts and CAT results can be found in Appendix B.

CASE A

The first student (C.J.), is a nine-year-old female in grade four at Kehewin School. Her name was selected from the arithmetic class printout dated May 19, 1988, sorted by urgency. Her name appeared fifth from the top indicating that according to the DEGEM system she was one of the students requiring teacher assistance. The printout indicated that she had completed her sixty-ninth session and was given an overall grade equivalent score of 2.9 years (Class Average 3.4). Eight topics are open to her and seven remain closed as her grade equivalent score is too low to permit her access to these topics. She has been dropped a level (more than 90 percent of the questions presented were responded to incorrectly, or the first three questions were incorrect) in four of the eight topics open to her. During her last session she was presented with forty-one questions of which she answered twenty correctly. Of the twenty-one she answered incorrectly, two were time out errors. That is, she did not respond within the allotted time.

To determine her grade-equivalent score in any given DEGEM topic, the two-digit number must be converted to years and months (i.e., 28 becomes 2.8 or 2 years 8

months). For Topic 2 the printout (25^1) indicates she is working at a Grade 2.5 level. She has been dropped a level and is currently working at Level 25.1. To interpret that, the Mathematics/Arithmetic Exercise Summary book is used. Under Topic 2 refer to Section 25.1. This section indicates that C.J. is currently working on single digit, horizontal addition questions like $6 + 8 = ?$ or $14 - 8 = ?$. Due to a drop in level, DEGEM indicates that she needs attention in the following areas:

Topic 3 (25^1)	Vertical Addition, one-digit to two-digit numbers, for example, $\begin{array}{r} 53 \\ +4 \\ \hline \end{array}$
Topic 4 (27^1)	Vertical Subtraction, multiples of 10 to 90, for example, $\begin{array}{r} 80 \\ -30 \\ \hline \end{array}$
Topic 5 (33^4)	Single Digit Multiplication, for example, $4 \times 4 = ?$; and division of a two-digit number by a one-digit number, for example $16/4 = ?$.

No other suggestions are given as to what course of action the teacher should take at this time. In Topic 5, for example, it is not known whether C.J. is having difficulty with multiplication, or division, or both. A diagnostic summary based on the DEGEM results reads as follows: C.J. is a grade four student who is currently experiencing a great deal of difficulty in mathematics. She is currently functioning at a Grade 2.9 level (Class Average 3.4). She is having difficulty with the four basic mathematics operations. During her last lesson she was dropped a level in four topics suggesting she had made a large number of errors or perhaps she was experiencing some frustration with the work. The DEGEM information indicates that she requires additional practice with her basic facts; first in addition, subtraction, and multiplication, then division. At this point, she is working primarily with one-digit and two-digit numbers. However, she is still not able to work with two two-digit numbers, unless they are multiples of ten. The DEGEM results suggest that C.J. should be given additional drill in her basic computation facts. Neither the printout nor the summary book offer any explanation or specific remediation activities for her difficulties.

C.J. wrote the Level 14 Canadian Achievement Test in May 1988 (Grade Level 4.8). Her grade-equivalent score on the total battery was 3.8. For the purposes of this exercise, only the mathematics section of the CAT will be discussed. The CAT results for C.J. are reported in Table 3:

Table 3

C.J.'s Canadian Achievement Test Results in Mathematics

Area	Grade Equivalent	Stanine Average	Percentile	Class
Math Computation	4.0	4	25	4.5
Concepts & Application	5.3	6	61	3.9
Total Math	4.5	5	44	4.2

An item analysis of C.J.'s CAT results indicates difficulty in the following areas:

- | | |
|-------------|--|
| Addition | <ul style="list-style-type: none"> - adding four four-digit numbers - adding columns of up to four-digit numbers - horizontal addition of up to four-digit numbers - adding like fractions - adding fractions, horizontally, no regrouping |
| Subtraction | <ul style="list-style-type: none"> - subtracting three-digit and two-digit numbers, no regrouping - subtracting three-digit and two-digit numbers - subtracting four-digit and three-digit numbers - subtracting two five digit numbers - subtracting like fractions - subtracting decimal fractions |

Multiplication	<ul style="list-style-type: none"> - multiplying one-digit numbers by ten, horizontally - multiplying a two-digit number by a one-digit number - multiplying two two-digit numbers
Division	- difficulty in all areas, however she can divide a two-digit number by a one-digit number (no regrouping).

As her scores were above average on the concepts and applications section, no recommendations are necessary. The CAT results indicate that C.J. is having difficulty in the area of computation skills with two-, three-, and four-digit numbers. Remediation would begin in the addition and subtraction areas with particular attention to number columns and regrouping. In the area of multiplication, C.J. would begin multiplying one-digit numbers by multiples of ten and then by other two-digit numbers. Instruction in division would not begin until C.J. has mastered the skills in the other basic operations.

Specific suggestions, given by item, are available in the Class Management Guide. For example, according to the item analysis on the CAT, C.J. answered question 21 incorrectly. This question is under Objective 45, addition. Suggestions for the intermediate level (grades 4 - 6) are found on page 110 of the Class Management Guide. One suggestion given is to duplicate a puzzle found on the page with the numbers omitted. C.J. would then put the numbers from one to nine in empty circles so that each set of three numbers connected by lines adds up to 15. Another suggestion recommends the use of a "Magic Square", basically a grid in which some numbers are missing and C.J. would have to fill in the missing numbers, ensuring that the sum of each row, column, and diagonal is the same number.

The same procedure could be applied for any incorrect response on any question where the total number of errors in the section exceeded 50 percent (designated by an "I" on the CAT). The resultant product would be developed into a specific educational plan for C.J. It should also be noted that it is not necessary to go to the level of item analysis to obtain this type of information.

When the CAT and DEGEM results are compared, C.J. is found to be weak in the area of mathematical computations. However, DEGEM identifies her as much weaker, indicating that she is having difficulty with basic number facts and simple

mathematical operations. On the CAT she was able to obtain correct answers on those types of questions. The CAT indicated her areas of weakness were at a higher level, that her basic facts had been mastered, and her difficulties involved operations with two-, three- and four-digit numbers. Therefore, in this particular instance there is some agreement as to the areas of concern. However, there does not appear to be a good match between these two diagnostic systems with respect to the level that C.J. should be working on. According to the CAT, C.J. has acquired skills DEGEM indicates she has not yet mastered.

CASE B

R.G. is a 12-year-old male in grade five at Onchaminahos School in Saddle Lake. His name was selected from the English class printout of May 1988, sorted by urgency. His name appeared at the top of the list, indicating that he was the student most urgently requiring teacher assistance. It should be noted that the criteria to be considered "urgent" does not depend on the relative grade level of functioning (i.e., the student the furthest behind is not necessarily the most "urgent"). Rather it depends on the number of areas or topics in which a student is "stuck", or has been dropped a level. The printout indicated that he had completed his fifteenth session and was given an overall grade-equivalent score of 3.7 years (Class Average 3.3). Thirteen topics are open to him and two remain closed as he is below the required entry level for these topics. The printout indicates that R.G. is having difficulty in the first group of exercises for topics 3, 8, and 15; in the second group of exercises for topic 10, and in the third group of exercises for topics 1, 4, 5, 9, 11, 12, 13, and 14. There is only one topic, topic 2, in which he is not experiencing any difficulty at this time. During his last session he was presented with forty-five questions of which he answered twenty correctly. Of the twenty-five he answered incorrectly, there were no time out errors. That is, he consistently responded within the allotted time.

The printout and the English Course Teacher's Manual indicate that R.G. is having difficulty with the exercises in the following areas:

Topic 1 (>36)	Letter and Word Attack Skills - He is having a problem with the third set of exercises involving different consonant sounds, for example c ("s", "k").
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Topic 3 (-37)	Pronouns and Noun Endings - He is having problems with the first set of exercises involving the plural of nouns ending in "y".
Topic 4 (>37)	Modals and Auxiliary Sentence Patterns - He is having difficulty with the third set of exercises involving the correct positioning and use of auxiliaries like "going to" as future before the main verb in a sentence.
Topic 5 (>36)	Verb Forms, Verbs - He is having problems with the third set of exercises involving the proper tense for the verb "be".
Topic 8 (-37)	Noun Phrases, Prepositions, Phrasal Verbs - R.G. is having problems with the first set of exercises involving prepositions of time "on, at, in".
Topic 9 (>37)	Sentence Patterns, Evaluative Reading - He is having difficulty with the third set of exercises involving the use of future tense with "going to" in an affirmative sentence.
Topic 10 (=37)	Verb Usage, Detailed Information - He is having some problems with the second set of exercises involving the use of past irregular tense with time expressions.
Topic 11 (>36)	Coordination, Reference - R.G. is having difficulty with the third set of exercises involving pronoun reference, specifically, the pronoun "it" as a subject or object.
Topic 12 (>36)	Punctuation, Classification, Context Clues - He is having difficulty with the third set of exercises involving classification (i.e. matching class names to examples of that class).
Topic 13 (>36)	Detail and Main Idea - This indicates that the student is having difficulty with the third set of exercises involving the recall of detail from a three-sentence passage.
Topic 14 (>36)	Sequence - R.G. is having some problems with the third set of exercises involving understanding the sequence in a compound sentence.
Topic 15 (-38)	Cause and Effect, Conclusions, Inferences - This indicates that the student is having difficulty with the first set of exercises requiring him to infer the effect on the basis of information given in one sentence.

A diagnostic summary based on the DEGEM results reads as follows: R.G. is a grade five student who is currently experiencing difficulty in the reading and language areas. He is currently functioning at the Grade 3.7 level (Class Average 3.3). He is having difficulty with word attack skills, grammar, syntax, classification, and reading comprehension skills (including recall of detail, sequencing, inference and determining cause and effect). During his last lesson, he experienced difficulty in 11 of the 15 topics, suggesting that he is making a large number of errors and may be experiencing some frustration. The DEGEM information indicates that he should be receiving remediation in three major areas: word attack skills; grammar and syntax; and reading comprehension skills. Particular attention should be paid to differing consonant sounds, verbs and verb tenses, parts of speech (i.e., pronouns, prepositions, and auxiliaries), recalling detail, sequencing, and inferring cause and effect. The DEGEM results suggest that R.G. should be working on some relatively basic decoding, reading comprehension, language expression, and language mechanics skills. It offers no further explanation or specific remediation activities for his difficulties.

R.G. wrote the Level 15 Canadian Achievement Test in May 1988 (Grade Level 5.8). His total battery score was Grade 5.8. For the purposes of this exercise, the reading, spelling, and language sections of the CAT will be discussed. The CAT results for R.G. are reported in Table 4:

Table 4

R.G.'s Canadian Achievement Test Results in Language

Area	Grade Equivalent	Stanine	Percentile	Class Average
Reading Vocabulary	5.2	5	41	3.2
Reading Comprehension	7.8	6	64	3.9
Total Reading	6.2	5	55	3.5
Spelling	7.0	6	62	5.6
Language Mechanics	11.8	7	82	4.0
Language Expression	3.4	3	21	3.4
Total Language	5.1	5	44	3.7

An item analysis of R.G.'s CAT indicate difficulty in the following areas:

Reading Vocabulary	- Some weakness with same meaning
Reading Comprehension	- Some weakness with contextual analysis - Weak critical comprehension
Spelling	- Some difficulty with silent single letters and "r" control
Language Mechanics	- Some problems with punctuation (i.e., exclamation marks and commas in addresses and quotations)
Language Expression	- Problems with pronouns (him, me) - Problems with verbs (present tense and perfect infinitive tense) - Problems with superlative adjectives - Problems with subjects/verbs - Problems with paragraph organization (i.e. irrelevant sentences).

The CAT results indicate that R.G.'s major area of difficulty is language expression, primarily in the areas of grammar, sentence structure, and paragraph organization. Additional remediation should be given in the areas of language mechanics (i.e. punctuation) and reading comprehension (i.e. contextual analysis and critical comprehension, both involving inference). If desired, some remediation could be introduced in spelling with silent single letters and "r" control. Specific suggestions, given by item, are available in the Class Management Guide. The suggestions are divided by level (i.e., elementary, intermediate, junior high) and will not be discussed as the format is the same as those listed above in CASE A.

When the CAT and DEGEM results are compared, R.G. is found to be weak in the area of language expression. Both diagnostic systems indicate that further work is required in the areas of grammar, specifically verbs, verb tense, parts of speech, and subject/verb agreement. Both systems suggest that R.G. may have some weaknesses in the area of organization. DEGEM suggests that he has difficulties sequencing, and the CAT indicates he has a problem with sentence structure and paragraph organization. However, the systems provide conflicting data regarding reading comprehension. DEGEM suggests that he requires assistance with some basic comprehension skills (i.e., recalling detail, sequencing, and determining

cause and effect) while the CAT indicates that he has mastered these skills and suggests remediation at a higher level of skill involving contextual analysis and critical comprehension. Therefore, there appears to be some match between these two diagnostic systems in the area of grammar and organization; however, in the area of reading comprehension the CAT results indicate he is able to function in areas that DEGEM indicates he has not mastered. Further, the CAT is suggesting remediation at higher levels. Finally, it may be noteworthy that according to both measures R.G. is generally functioning above his class average. The DEGEM system identifies 12 areas where he requires assistance while the CAT identifies one, possibly two. In addition, the CAT identifies four areas of strength.

CASE C

C.G., is a 10-year-old male in grade three at Kehewin School. He wrote the Level 13 Canadian Achievement Test in May 1988 (Grade Level 3.8). His total battery score yielded a grade-equivalent of 2.6. The CAT indicated that C.G. was low in all areas of mathematics; therefore, for the purposes herein, only the mathematics section of the CAT will be discussed. The CAT results for C.G. are reported in Table 5.

Table 5

C.G.'s Canadian Achievement Test Results in Mathematics

Area	Grade Equivalent	Stanine	Percentile	Class Average
Math Computation	2.9	3	11	3.4
Concepts & Application	2.5	3	14	3.3
Total Math	2.6	2	10	3.4

An item analysis of C.G.'s CAT indicates difficulty in the following areas:

- | | |
|----------|--|
| Addition | <ul style="list-style-type: none"> - adding 2 two-digit numbers, horizontally - adding 3 two-digit numbers, horizontally - adding 3 two-digit numbers - adding 2 two-digit and 2 one-digit numbers |
|----------|--|

	- adding 2 four-digit numbers
	- adding up to three-digits, horizontally
	- adding 4 four-digit numbers
Subtraction	- subtracting two and one-digit numbers
	- subtracting 2 two-digit numbers
	- subtracting three and two-digit numbers
Multiplication	- basic facts, 2 one-digit numbers
	- multiplying 10 by a one-digit number
	- multiplying two by one-digit numbers, no regrouping
	- multiplying three by one-digit numbers, horizontally
Division	- basic facts, 2 one-digit numbers
	- basic facts, two-digit divided by one-digit numbers
	- multiples of 10 divided by one-digit numbers
Numeration	- renaming thousands, hundreds, and ones
	- adding number line sentences
	- rounding three-digit numbers, nearest 100
Number Theory	- odd, even numbers
	- factors of 4 and 8
Number Properties	- identifying elements of multiplication
	- division equations, solving for the box
	- symbol for true sentences, multiplication
Common Scales	- reading clock and adding time
	- counting money
	- reading calendar, day on date
Measurement	- perimeter of rectangle
	- story problem, multiplying kg
	- story problem, convert m to cm
	- estimate volume, L
Problem Solving	- identifying process, subtraction
	- identifying process, subtraction and addition
	- solving by multiplying
	- solving by dividing

The CAT also identified some weaknesses in the areas of graphs and geometry. These areas will not be discussed here as they are not included in the DEGEM diagnostic system.

The CAT results indicate that C.G. is having difficulty in all areas of mathematics computation; some areas of numeration, number theory and number properties; some areas of measurement and common scales; and in problem solving. Although he knows his basic addition and subtraction facts and understands the commutative and associative properties, he requires further remediation before he is ready to work with larger numbers (i.e., three- and four-digit) using these operations. He requires drill in his basic facts for both multiplication and division. His work in problem solving should reflect this by supporting his strengths in addition and subtraction and should require little or no work in multiplication or division at this time. In addition, emphasis should be placed on improving his knowledge of and skills in measurement, and using common scales (i.e., money, calendar, clock). Specific suggestions, given by item, are available in the Class Management Guide.

C.G.'s name appeared third from the top on the DEGEM arithmetic printout for her class, dated May 1988, sorted by urgency. This indicates that according to the DEGEM system he is one of the students requiring teacher assistance. The printout indicated that he had completed his seventy-first session and was given an overall grade equivalent of 2.6 years (Class Average 2.9). Seven topics are open, that is, he has access to these topics. The teacher has closed the remaining topics (2) to all of her students. C.G. has been dropped a level (more than 90 percent of the questions presented were responded to incorrectly, or the first three questions were incorrect) in four of the seven topics open to him. During his last session he was presented with twenty-five questions of which he answered nineteen correctly. Of the six he answered incorrectly, one was a time out error. That is, he did not respond within the allotted time.

For Topic 1 the printout (25^2) indicates he is working at a grade 2.5 level. He has been dropped a level and is currently working at Level 25.1. To interpret that, the Mathematics/Arithmetic Exercise Summary Manual is used. Under Topic 1 refer to Section 25.1. This section indicates that C.G. is currently working on numerical systems, specifically, filling in the missing number (with increasing even numbers, from 2 to 24). Other areas that DEGEM indicates he needs attention due to this drop in level are:

- Topic 3 (27^1) Vertical Addition, three addends: multiples of 10; sum up to 90.
- Topic 4 (26^1) Vertical Subtraction, minuends of 20 to 49 and subtrahends of 1 to 9.
- Topic 14 (22^08) Word Problems, single digit addition and subtraction.

There are no further suggestions as to what course of action the teacher should take at this time. A diagnostic summary based on the DEGEM results would be as follows: C.G. is a grade three student who is currently experiencing difficulty in mathematics. He is currently functioning at a Grade 2.6 level. He is having difficulty with the operations of addition and subtraction. During his last lesson, he was dropped a level in four topics which would normally suggest that he made a number of errors; however, in this particular case, C.G. only made six errors out of twenty-five questions. At this point in time, he would be working with simple addition and subtraction operations, with primarily one- and two-digit numbers. In addition, some work in numerical systems is required to enhance his understanding of number theory.

When the CAT and DEGEM are compared, C.G. is found to be weak in the area of mathematics computation with DEGEM placing him slightly weaker (0.3). Both diagnostic systems specify remediation in the operations of addition and subtraction using one- and two-digit numbers. However, the CAT diagnostics offer more detail and include additional areas (i.e., number theory, measurement, and common scales).

DISCUSSION: QUESTION THREE

There is no clear and simple answer to this question. The pivotal point of this discussion is *How can the DEGEM results be accurately compared to any other system or standardized instrument?* Basically, DEGEM results yield raw scores and grade equivalents. The comparison of raw scores is not appropriate and the meaning of grade equivalent scores vary from instrument to instrument. As far as can be determined, as it is never stated clearly in any of the literature or manuals which come with the system, the DEGEM grade equivalent scores appear to be criterion referenced scores. That is, a curriculum was analyzed (probably for the

state of New York), and it was determined that a child in the fourth month of grade three was able to do a specific type of problem. Therefore, when a child is successful at similar problems on DEGEM he is given a grade equivalent score of 3.4. On the CAT, which uses Canadian norms, if a grade two student were to obtain a grade equivalent score of 3.4, it means that the student obtained the same raw score as a student in Grade 3.4 would have obtained on the level 12 test. It does not necessarily mean the student is functioning at the grade 3.4 level. It is apparent that comparisons cannot be made by grade equivalent scores. Subsequently, the case study format was decided upon. Before leaving this issue it should be stated that it will be important for Alberta Education, as they attempt to answer Question Two, to examine the issue of how the DEGEM system is normed (or referenced) and what the implications are for Alberta students.

As was seen in the results section, there are some advantages and disadvantages to the DEGEM diagnostic system. The intent of this discussion is to highlight these with respect to the capabilities of the chosen standardized diagnostic test instrument, the Canadian Achievement Test. The discussion will revolve around three central issues: the validity and accuracy of the diagnostic assessment itself; the utility of the results for developing an individualized program for the student; and its ease of use for the teacher.

With respect to the first issue regarding the validity and accuracy of the DEGEM diagnostic assessment itself, it is important to examine the results of the DEGEM printout in context. In other words, it is important to consider the results of the DEGEM printout in conjunction with the student's daily work, his school marks, his past academic history, and his teacher's perceptions, as diagnostic instruments are not generally intended to be used in isolation. Since this level of detailed information is not available for each student, teachers were asked how the DEGEM results compared to other information they had on their students. There was general agreement that the system provided information which was similar to the other information they had; however, with respect to the issue of grade equivalents, there was general dissatisfaction with the grade equivalent scores (i.e., they seem to the teachers to be too low). It is noteworthy that the grade equivalent scores continue to be the most used "diagnostic" feature of the printout. Perhaps this is because teachers recognize these scores, even though the true meaning may be rather obscure.

As the case studies demonstrate when the information received from the DEGEM printout was compared with information obtained from the CAT, there is some match between these two diagnostic systems. However, in all three cases, DEGEM appears to place the student at a lower grade equivalent level than the CAT. DEGEM also appears to focus more on the skills involved in the subject matter rather than on the concepts. This is true for mathematics; of the fifteen topics covered, only two or three topics could be considered to refer to concepts. This is also true for language arts where, again, only about five of the fifteen topics involve concepts. The remaining topics heavily emphasize skills in language mechanics and expression. The CAT results offer a more balanced weighting, placing a more equitable emphasis on both concepts and skills. This difference may be a reflection of the nature of a CAI system which is better suited to provide support for the basic skills involved in the mathematics and language arts curricula. Depending upon the specific needs of the student and the teacher, this may be perceived as a strength or a limitation.

With reference to the second issue, the utility of the DEGEM diagnostic system results in the development of individualized programs for students, it is important to consider both the student's strengths and weaknesses. If a teacher knows what a child does well, this information can be used as a starting point to plan the child's program; at this point success and motivation are automatically built in. One drawback of the DEGEM system results is that it only reports weaknesses (i.e., when a student is dropped a level or is "stuck"). In order to discover a student's strengths the teacher is required to use the grade equivalent score for a topic, refer to the Mathematics/Arithmetic Exercise Summary Manual and/or the English Exercise Description, examine what specific types of exercises the student is working on, and which skills the student has previously mastered. In comparison, the CAT offers a one-page summary of each individual student's strengths and weaknesses which are available at a glance on the Objectives Competency Report (individual student report) or in more detail on the Group Response Record (item analysis). If a teacher wishes more detailed information and sample remedial exercises reference to the Class Management Guide.

When assessing the utility of the DEGEM diagnostic results, it is important to consider the accuracy of the initial level of placement for the student. It is important

that the student is placed at a level where he is able to succeed, but where he is being "stretched" or challenged. The three case studies seem to indicate that DEGEM may be placing the students at a level where they are not challenged. There is some evidence that DEGEM may be under assessing the student's current level of achievement. This was apparent in that DEGEM often showed the student was working at a specific level, yet the CAT results indicated that the student was able to correctly answer questions at, and above, the level specified by DEGEM. In addition, topics which may be closed to a student because of his overall grade level score, were areas where the student demonstrated some level of competency on the CAT. One possible explanation may be that DEGEM presents a number of the same types of questions to students and unless the students can demonstrate mastery they are dropped a level. The CAT presents one or two questions for the student in the area, and perhaps having fewer questions on a topic works in the students favor. Another possibility is that the DEGEM system requires the student to solve the questions mentally, while the CAT allows the use of pencil and paper. Perhaps DEGEM is measuring memory skills as well as mathematical or language skills. This may explain how a student can succeed in one area (CAT) and fail in another area (DEGEM) when the areas are at the same level of difficulty.

A third explanation arises; it is possible that security at sign-on is a problem with the system. If so, this may adversely effect the accuracy of the system's results. During several observations of computer use, it was noticed that a number of students signed-on with an I.D. number belonging to their friends or relatives. Alternatively, sign-on could be achieved by randomly entering numbers (four or five digit) until a student was able to sign-on. The actual frequency of this occurrence is unknown; however, at the individual level this would greatly affect the diagnostic results for a student. If this were a common occurrence, there would be implications at the class level.

Cases where students were randomly keying responses until they got the correct answer were also observed. This seemed to occur with the younger students, especially with word problems. If the child could not read the word problem, yet sees the numbers "4" and "3" he would enter "7". If the computer indicated error, he would enter "1". This would be seen from the computer's diagnostic perspective, as an inability to subtract single digit numbers less than five, when in fact it is a reading comprehension problem. Randomly keying responses would

also impact the validity of the diagnostic system's results; patterns which emerge would not be patterns at all. This could also account for possible error in the diagnostic capability of the system.

It was also observed that there were some students who did not seem to take their time on the computer too seriously, that is, they were inattentive, punching keys randomly, and generally off-task, regardless of the questions. This observation was supported in part by the time on task data, which indicated that there was no significant difference in time on task on the computer versus the class, and by the teacher questionnaire data which indicated that teachers perceived that eleven to twenty percent of their students were off-task while working with DEGEM. These behaviours could invalidate the diagnostic results provided by the system. Therefore, students' perceptions of the system's function and student motivation are important factors which can affect the quality of input into the system. This directly affects the quality of the system's output (i.e., diagnosis). This is also true for other diagnostic instruments; however, the testing environment, combined with closer teacher supervision and scrutiny, tends to minimize some of the effects discussed above. All, or any combination of the above, could be a possible explanation for lower performance results on the DEGEM system.

Another important issue to consider is the comprehensiveness of the diagnostic results provided by DEGEM. It is preferred that this system provide a comprehensive overview of each student's level of achievement, and specific areas requiring attention in both mathematics and language arts. As discussed earlier, the DEGEM system heavily emphasizes the skill components in these subjects and places less emphasis on the concepts. Therefore, it provides less information regarding the student's weaknesses at a conceptual level. This requires the teacher to use other diagnostic assessment instruments to obtain this information. This can be problematic and time-consuming; thus, may result in a heavier emphasis on skills, by "default". Hence, it is possible that remediation may be "skewed" in favor of skills, with an insufficient emphasis on concepts. This may be considered a significant limitation of the DEGEM diagnostic system. Additionally, it is unfortunate that the DEGEM system itself provides no remedial sub-routines for students to follow. If, in fact, the system is able to pinpoint areas of difficulty, it would seem within the scope of current technology to incorporate sub-routines which would also provide individual remediation for the student.

The final issue to consider in determining the adequacy of the DEGEM diagnostic system, is its ease of use for the classroom teacher. As noted in the results section when reporting the results of the teacher questionnaire, many teachers found the DEGEM reports difficult to interpret. This limits teacher use, and therefore the effectiveness of the diagnostics. During the preparation of the DEGEM case study profiles, the process of interpreting the printouts was extremely time-consuming and frustrating, requiring continual reference from one source to another (i.e., printout, teacher's manual, and exercise summary book). To prepare a written diagnostic profile using DEGEM results is estimated to take at least an hour. This time would decrease with familiarity with the materials; however, the number of cross references required would still utilize a considerable amount of time. As well, it must be remembered, that when the diagnostic profile is completed, one must then develop a remedial program, search out, and acquire suitable materials for remediation.

One serious weakness which interferes with the ease of use of the printout, is that although the same coded symbols are used for both the mathematics and language arts printouts, they do not necessarily have the same meanings, either within a printout, or between printouts. For example the ">" symbol on the mathematics printout has two meanings. If it appears to the right of the TO/ER column it means the time allotment for that student has been increased or decreased. If it appears to the right of an exercise level, it means that the student is "stuck" and requires assistance. It also serves as a decimal point when the teacher looks the question up in the exercise manual (i.e., 31>2 becomes 31.2 in the exercise manual). In the language arts section ">" means that the student is having problems in the third group of five exercises (other symbols are used to denote the first and second group). The symbols appear to have been arbitrarily assigned, making it difficult to remember them (as opposed to using symbols which would have some link with what they indicate). As well, the issue is further confused by giving the same symbol different meanings. Since the classroom teacher is faced with expanding roles and responsibilities in education, it is imperative that a diagnostic system is understandable and efficient to use. By comparison, the CAT diagnostic system was easier to understand, and less time-consuming.

Another important feature for the teacher, when employing a diagnostic system, is the system's provision for remediation strategies. Once teachers know what the problem is, they want to know what to do about it. Other than providing drill and practice in the area of deficit, the DEGEM system does not provide any support in this area. The teacher is left to find appropriate strategies and materials to use with the student in remediation. This is a very time-consuming process which requires suitable and available resources. In view of the other time pressures on the teacher, this may or may not happen. As reported on the teacher questionnaire, most teachers agreed that they now had a better understanding of their students' weaknesses, they also agreed that they did not know what to do about them, or how to begin remediation. This can be considered a serious shortcoming of the DEGEM system's diagnostic capability. In contrast, the CAT provides specific sample strategies for remediation, for three grade ranges, in the Class Management Guide.

In conclusion, the DEGEM system appears to have some appropriate diagnostic capabilities, especially in the skill areas of mathematics (computation) and language arts (language mechanics and language expression). Its diagnostic capability in conceptual areas is limited. It appears to have the student working at a lower skill level than the CAT generally indicates. The system focuses on weaknesses rather than strengths and provides no suggestions for remediation. The DEGEM reports are difficult to interpret and require great familiarity with the mathematics and English programs (i.e., fifteen topics in each). System security, student perceptions, and student motivation may be important factors affecting the validity of the system's diagnostic results.

QUESTION FOUR - *How useful and appropriate are the DEGEM CAI inservice training preparations perceived to be by the teachers at Kehewin and Saddle Lake relative to system management, system use, and authoring courseware?*

During the first year of the project (1987-1988), a significant portion of the teacher questionnaire was committed to the issue of inservice. The interim report indicated that the effectiveness of the DEGEM system was dependent, to a large extent, upon the individual teacher's understanding of how to fully utilize the system. It was apparent from both the questionnaires and face-to-face interviews that this objective had not been realized. Therefore, one of the most crucial recommendations made when the interim report was submitted, was for more inservice time to be arranged for teachers. This fact was also highlighted with the respective administrations, teachers, and with the Steering Committee. When the final round of data were being collected, both schools indicated that no teacher inservices had been conducted at either site during the 1988-1989 school year. At Kehewin a new systems manager who began in September 1988, had been given virtually no inservice. A second systems manager was hired in February 1989. He, however, received some assistance from the systems manager who was employed during the 1987-1988 school year. As no teacher inservice had been conducted since the interim report, no further questions were included on the teacher questionnaire regarding inservice; therefore, what follows are the results of the 1987-1988 data collection. It is important to note that the recommendations for continued inservice are still very much appropriate.

This qualitative data was gathered at both sites by means of a structured questionnaire late in the 1987-1988 school year. In addition to the teaching staff, the systems managers and administrators from both schools were invited to participate. All but one administrator responded by filling out the questionnaire. In addition, a structured, open-ended, face-to-face interview was conducted with all teachers. It must be remembered that the results for this section reflect the views of the respective staffs in 1988. This may or may not be representative of their current views. This is especially true at Kehewin where there has been a significant staff turnover since June 1988. At the suggestion of the Steering Committee, the

questions regarding inservice were divided into two groups; the inservice given by the DEGEM personnel, and the inservice given by the local systems manager. The questions devoted to the topic of inservice appear in Table 6, with the mean values for each group of teachers reported (Kehewin teachers' results are reported under the column heading "Keh", and the Onchaminahos teachers' results are reported in the column titled "Onc").

It should be noted that the staff at Kehewin have received more inservice than the staff at Onchaminahos. This is, in part, due to the fact that the system has been in place one year longer at Kehewin. There was little or no training conducted prior to the arrival of the systems in either school, as the systems arrived with little advance warning. The systems managers were selected in a relatively arbitrary manner, and the staffs and administrations did not appear to receive any training in advance of the arrival of the systems.

Generally, teachers tended to agree more with the global, "motherhood" type questions (e.g., "I was satisfied with the level of training I received regarding the DEGEM computer") than with specific, focused questions. (e.g., "As a result of the training, I have an adequate knowledge of the operation of the student diagnostic system"). Mean values for each of the questions, by school, were obtained. This allows for comparison of teacher perceptions between schools. T-tests were run on the mean values to determine whether significant differences ($p < 0.001$) occurred in the teachers responses. Generally, it appears that the teachers at Kehewin are more positively predisposed to the DEGEM system than those at Onchaminahos. Regardless of any differences, both staffs were clear in their desire for additional and regular inservice.

The specific discussion of inservice will begin by examining the inservice delivered by the DEGEM staff. Both groups of teachers were generally satisfied with the level of training they received and indicated that their comfort level with DEGEM was enhanced. When asked whether the DEGEM system worked as well as they were told it would, there was a significant difference between the groups; the Kehewin teachers agreed while the Onchaminahos teachers tended to disagree. The administrators who responded were reversed with Kehewin responding lower and Onchaminahos rating it higher. The same split was evident when the administrators

were asked whether their teachers were satisfied with the level of training they received.

A series of questions were asked of teachers as to whether or not they have increased their knowledge of specific aspects of the system as a result of the inservice. Responses with respect to the operation of the hardware, software, authoring system, student diagnostic system and registering a class ranged from general disagreement to neutrality. The sole exception being that teachers stated they had a better knowledge of the recordkeeping functions as a result of the inservice. Administrators indicated that they did not have an adequate knowledge of the recordkeeping functions as a result of the inservice. When asked whether there were major content areas that were not covered in the training, the teacher's responses were somewhat ambivalent with the Onchaminahos teachers indicating that it was more likely sections were omitted. There was general satisfaction with the level of expertise of those conducting the inservice. With respect to the pacing and information presented, Kehewin teachers tended to respond slightly more favorably. One administrator observed that, "The use of the system depends a great deal on how comfortable the teacher is using a computer . . . more time should be spent in encouraging staff to be computer literate."

The following section reports teacher responses to the inservice provided locally . Perhaps the clearest statement made by teachers with respect to inservice was made in this section. When asked to respond to "I would not find periodic upgrading useful", both groups strongly disagreed. The same questions regarding areas such as hardware and software were asked in this section. The responses were very similar to the section above, generally somewhat higher (perhaps 0.1), but reflecting the same pattern. Again, both groups were satisfied with the level of expertise of those providing the inservice. There was a significant difference between groups when asked, "I understand the intended use of DEGEM in my school", with the Kehewin group reporting more agreement. The administrators responded to this question positively, with the administration at Onchaminahos indicating stronger agreement .

When the systems managers were asked if they were aware how the system was to be implemented in the school, their responses differed, with the Kehewin systems manager indicating more agreement. When asked if they had all the information

they required prior to the systems arriving in the school, both strongly disagreed. They were also asked if they now had all the information they required and the response was general agreement. They indicated some agreement with the statement that they have received adequate training from the DEGEM staff and both agreed that their training differed significantly from the teachers' training. The suggestion was made by one systems manager that during future inservices teachers could benefit from a greater emphasis on how system use could be better integrated into the teaching of subject matter in the classroom.

On the open-ended portion of the teacher questionnaire, the comments indicated that teachers wanted more time for inservice and a greater depth of understanding the system. One teacher indicated, "Basically we were given a student level experience on the computer", another stated, "I did receive some training - basically how to turn the thing on. I have no idea how to obtain different questions etc." Several commented that the inservice was "quick and superficial" and more time is required. As well, follow-up sessions were requested; "Short sessions on a regular basis would allow us to apply what we are learning". One teacher stated that the "hands-on experience was good, but we did not learn anything about individualizing or setting programs". There did not appear to be any specific differences in the written comments between the two schools.

Table 6

Mean Values of Inservice Questions - Teacher Questionnaire

	1988	
	Keh	Onc
31. I was satisfied with the level of training I received regarding the DEGEM computer system.	2.3	2.3
32. I found my comfort level with the DEGEM system was enhanced by the training I received.	2.6	2.6
33. I saw new ways to deliver the curriculum to my students using the DEGEM system.	1.9	1.4
34. The DEGEM system has worked as well they told me it would.	3.0	1.5

Table 6 Continued

Mean Values of Inservice Questions - Teacher Questionnaire

	1988	
	Keh	Onc
35. As a result of the training, I have an adequate knowledge of the operation of the DEGEM HARDWARE.	1.1	2.4
36. As a result of the training, I have an adequate knowledge of the operation of the DEGEM SOFTWARE.	1.8	1.9
37. The training has provided me with adequate knowledge of the operation of the DEGEM record keeping functions.	2.3	2.1
38. As a result of the training, I have an adequate knowledge of the operation of the DEGEM authoring system.	1.0	1.5
39. As a result of the training, I have an adequate knowledge of the operation of the DEGEM student diagnostic system.	1.8	1.6
40. As a result of the training, I have an adequate knowledge of how to register my class on the DEGEM system.	1.1	1.6
41. Since I was training on the DEGEM system I have found new uses for the system that were not covered in the training.	1.9	.9
42. There were major content areas not covered in the training.	2.0	2.5
43. I suffered from information overload during the training.	2.0	1.9
44. I found the pacing of the training to be inappropriate.	2.4	1.7
45. I was satisfied with the expertise of the individuals who did the training.	2.9	3.0
46. I would not find periodic upgrading useful.	0.4	0.6
47. I found my comfort level with the DEGEM system was enhanced by the training I received.	2.7	2.4
48. As a result of the training, I have an adequate knowledge of the operation of the DEGEM HARDWARE.	1.3	2.0
49. As a result of the training, I have an adequate knowledge of the operation of the DEGEM SOFTWARE.	1.7	1.6

Table 6 Continued

Mean Values of Inservice Questions - Teacher Questionnaire

	1988	
	Keh	Onc
50. The training has provided me with adequate knowledge of the operation of the DEGEM record keeping functions.	2.3	2.0
51. As a result of the training, I have an adequate knowledge of the operation of the DEGEM authoring system.	1.2	1.3
52. As a result of the training, I have an adequate knowledge of the operation of the DEGEM student diagnostic system.	2.8	1.6
53. As a result of the training, I have an adequate knowledge of how to register my class on the DEGEM system.	1.3	1.1
54. I suffered from information overload during the training.	1.3	1.9
55. I found the pacing of the training to be inappropriate.	1.4	1.9
56. I was satisfied with the expertise of the individuals who did the training.	3.3	2.9
57. I understand the intended use of the DEGEM system in my school.	3.1	2.0

DISCUSSION: QUESTION FOUR

In 1988 the teachers in both schools demonstrated a positive response toward the inservice provided. There were no significant differences portrayed between the quality of inservice provided by the DEGEM system people, or locally, by the systems managers at each school. Significant differences between the teacher groups was noted with the Kehewin teachers generally being more positively oriented toward the system. There are several hypotheses which could be tendered to account for the difference. First, the Kehewin teachers have received more inservice with respect to DEGEM; therefore, perhaps they are more comfortable with the system and understand it better. Second, the Kehewin teachers have used

the system for just over one year longer than the Onchaminahos teachers. This exposure could account for the difference in orientation. Third, and most likely, there was a major system failure at Onchaminahos last spring (1988). Eventually, all the student data were lost, and the system did not function well for several weeks. Students were "rolled back" in the topics they were working on, causing much frustration for all concerned. Finally, all the data were entered manually for each student by the systems manager, and the system was again operational, toward the end of the school year. Unfortunately, as no inservice was conducted in the subsequent year, it is difficult to select a "most likely" hypothesis.

When teachers were asked about specific areas where they had acquired knowledge about DEGEM, they appeared to have some difficulty pinpointing where their knowledge base had been enhanced. However, when asked general questions the responses were quite positive. From this it would appear that generally, teachers want to have the system in the school, but are not familiar enough with the system to utilize it in any sort of diagnostic sense. This was confirmed during the structured interviews, although several teachers indicated they used the system to diagnose student needs, very few were able to give any type of specific indication of how that was being done.

With respect to system use, it appears that all teachers are able to use the system. That is, they can turn it on and have their students follow the program. With respect to system management, that is altering the system for their own specific needs, or readily understanding and implementing the diagnostic printout, there is a varied but generally poor ability to do so. Authoring is a feature not used by anyone, systems managers nor teachers. When responding to some of the same questions asked of teachers, the administrators did not always seem to have an accurate perception of how their staff used, or perceived, the system. This could be in part due to the fact that only one administrator actually used the system and had first hand knowledge.

Question Five - *Does the use of DEGEM CAI result in improvements in students' thinking skills (cognitive strategies skills) relative to conventional instruction?*

The Test of Cognitive Skills (TCS) was selected as the instrument used to measure thinking skills. It was administered to all students who wrote the CAT with the exception of some of the special education students whose teachers chose not to administer it. The TCS was administered during the same time frame as the CAT. Most students who wrote the CAT wrote the TCS although this is not universally true. As with the CAT, no clear trends have emerged with respect to the effect of CAI on thinking skills.

In 1988, the results comparing Grade 2A with Grade 2B, Grade 3A with Grade 3B, Grade 4 with Grade 5, and Grade 5 with Grade 6, are reported in Table 7. The Grade 7 class was not included in this study. The TCS results reported are based on the average raw scores for each class on five measures - sequencing, analogies, memory, verbal reasoning, and total battery.

The Grade 2A (n=18) class is stronger on all measures than the Grade 2B (n=18) class except for memory, where the 2B class scored higher. There were no significant differences between the groups except on the sequencing subtest (in favor of 2A).

The Grade 3A (n=22) class is stronger on all measures than the Grade 3B (n=16) class except for sequencing, where the 3B class score is statistically significantly better than the 3A class. On the analogies subtest, the 3A class demonstrates a statistically significantly higher score.

The Grade 4 (n=22) class shows no statistically significant differences when compared to the Grade 5 class; however, they demonstrate higher means on the sequencing and verbal reasoning subtests. The Grade 5 (n=19) class shows better scores on analogies, memory, and the total battery.

Table 7

Mean Scores on the Test of Cognitive Skills Reported By Grade

Grade 2A By Grade 2B

Area	Means		Standard Dev.		T	Prob.2-Tail
	2A	2B	2A	2B		
Sequencing	441.5	372.3	81.9	94.5	2.3	0.03
Analogies	406.5	378.9	147.4	99.2	0.7	0.52
Memory	582.7	634.6	99.0	70.3	-1.8	0.08
Verbal Reasoning	435.4	411.7	115.2	122.7	0.6	0.56
TOTAL	468.6	449.5	95.8	70.6	0.7	0.51

Grade 3A By Grade 3B

Area	Means		Standard Dev.		T	Prob.2-Tail
	3A	3B	3A	3B		
Sequencing	361.6	443.7	119.1	70.4	2.3	0.03
Analogies	436.4	332.0	85.6	203.9	2.1	0.05
Memory	513.5	496.5	59.3	43.4	0.9	0.36
Verbal Reasoning	458.2	412.0	83.1	123.4	1.3	0.19
TOTAL	444.4	434.5	52.8	74.6	0.5	0.66

Grade 4 By Grade 5

Area	Means		Standard Dev.		T	Prob.2-Tail
	4	5	4	5		
Sequencing	448.1	420.6	106.7	110.1	0.7	0.50
Analogies	379.5	416.1	120.3	77.0	-1.0	0.35
Memory	497.9	522.5	73.5	79.0	-0.9	0.38
Verbal Reasoning	476.9	465.5	500.4	92.2	0.4	0.66
TOTAL	451.1	457.5	56.2	77.0	-0.3	0.80

Table 7 Continued

Mean Scores on the Test of Cognitive Skills Reported By Grade

Grade 5 By Grade 6

Area	Means		Standard Dev.		T	Prob.2-Tail
	5	6	5	6		
Sequencing	420.6	570.7	110.1	103.6	-3.8	0.00
Analogies	416.1	532.2	77.0	106.6	-3.3	0.00
Memory	522.5	704.2	79.0	99.7	-5.4	0.00
Verbal Reasoning	465.5	520.8	92.2	69.6	-1.9	0.07
TOTAL	457.5	587.1	77.0	67.6	-4.8	0.00

The Grade 3A (n=22) class is stronger on all measures than the Grade 3B (n=16) class except for sequencing, where the 3B class score is statistically significantly better than the 3A class. On the analogies subtest, the 3A class demonstrates a statistically significantly higher score.

The Grade 4 (n=22) class shows no statistically significant differences when compared to the Grade 5 class; however, they demonstrate higher means on the sequencing and verbal reasoning subtests. The Grade 5 (n=19) class shows better scores on analogies, memory, and the total battery.

The Grade 5 (n=19) class is weaker than the Grade 6 (n=19) class on all measures. In fact, the Grade 6 group scored statistically significantly better on all measures except verbal reasoning.

Correlations were developed between the total battery score on the CAT and the four subtest scores on the TCS as well as the total score on the TCS. It is expected that the correlations would be in the 0.7 range, as that is the correlation figure generally accepted when discussing the relationship between intelligence and achievement. Table 8, presents the correlation figures between the total battery raw score on the CAT and the total raw score on the TCS.

Table 8

Correlations of Total Scores By Grade on the Canadian Achievement Test And The Test of Cognitive Skills

Onchaminahos School	Correlation	Kehewin School	Correlation
Grade 2	0.57	Grade 2	0.40
Grade 3	0.54	Grade 3	0.25
Grade 4	0.56	Grade 4	0.90
Grade 5	0.89	Grade 5	0.85
Grade 6	0.72	Grade 6	0.82
TOTAL Grades 2-6	0.56	TOTAL Grades 2-6	0.54

Caution must be exercised in interpretation, as the sizes of each class, hence the total number of subjects in each school, are relatively small. It can be seen however that the correlations appear to be much stronger in the higher grades, and that the total correlation for all grades combined is somewhat lower than would be expected.

Qualitative information was gathered from teachers in each school with respect to thinking skills and is reported in Table 9. When asked if there had been an improvement in their students' thinking skills (1988), Kehewin teachers tended to agree while Onchaminahos teachers tended to disagree. In 1989 the Onchaminahos teachers' responses were somewhat closer to the 1988 Kehewin teachers' responses. With respect to the way that their students approach problems since being on DEGEM, both groups saw their strongest students having derived the greatest benefit, followed by their average students, and finally, their weaker students benefiting least. In 1988 there were no large differences between the scores. In 1989 the Onchaminahos teachers indicated much stronger agreement that DEGEM assisted both the stronger and the average students, while they continued to disagree that the system was an asset to the weaker group. Both groups tended to agree that their students were better able to sequence information since using the system.

Table 9

Mean Values of Thinking Skills Questions - Teacher Questionnaire

	1988		1989
	Keh	Onc	Onc
58. Since my students have been on the DEGEM system, I have noticed an improvement in their thinking skills.	2.4	1.8	2.1
59. Since my students have been on the DEGEM system, I have not noticed any changes in the way they approach problems they encounter.	1.6	2.3	1.6
60. Since my students have been on the DEGEM system, I have noticed that my stronger students approach problems they encounter in a superior way.	2.0	2.1	2.9
61. Since my students have been on the DEGEM system, I have noticed that my average students approach problems they encounter in a superior way.	1.9	1.9	2.9
62. Since my students have been on the DEGEM system, I have noticed that my weaker students approach problems they encounter in a superior way.	1.6	1.6	1.6
63. My students are better able to sequence since using the DEGEM system.	2.4	2.0	2.6
64. My students who are better able to sequence benefit more from the DEGEM program.	2.1	2.5	2.5

Five teachers made additional written comments (1988) with respect to this issue. One person indicated that no difference has been noticed. Another indicated a slight improvement in problem solving ability. The third suggested that the children are more confident on the system and, therefore, attempt more problems. Two saw changes but could not attribute them to DEGEM; "I confess to not really noticing

improvement which could be attributable to the use of the system", and "It is difficult to state changes are solely the result of the system . . . we have put in place new mathematics, language arts and science programs."

DISCUSSION: QUESTION FIVE

This question is similar to Question One, except thinking skills rather than student achievement are the issue. One thing that is clear, is that, thinking skills are harder for teachers to measure, even informally, than is achievement. The qualitative data were gathered from both sites while quantitative data were received only from Onchaminahos School.

With respect to the qualitative data, there was modest agreement that DEGEM was having a positive effect on thinking skills. Teachers seemed to have difficulty with this section, as only five of the seventeen wrote any comments at all (1988), and only one indicated that any changes in thinking skills could be attributed to DEGEM. Over time the Onchaminahos teachers tended to respond similarly, although in the area of assisting stronger and average students, their responses were more positive.

The quantitative data that were available are insufficient to yield any differences or trends. The correlations run between the CAT and the TCS show a large degree of variability among grade levels. Unfortunately, as no useable quantitative data from 1989 are available due to cohort contamination and subjects leaving the study, no conclusions regarding the effect of DEGEM on thinking skills can be drawn. Even the qualitative information does not yield any definitive statement as to whether these students' thinking skills were enhanced by their exposure to DEGEM. The one area where a trend emerges is that the teachers agree that the stronger and average students derive the most benefit from working on the system, while the weaker students benefit the least.

QUESTION SIX - *To what extent are teachers and administrators able to implement the DEGEM CAI program as intended with respect to activities such as the following: individualized instruction; diagnosing students' strengths and weaknesses and assigning appropriate entry level tasks; supplementing, complementing, and integrating CAI with conventional and creative teaching; reteaching as required; evaluating and recording pupil progress; and applying mastery learning principles? What are teachers' perceptions about the appropriateness and usefulness of the courseware? What are teachers' perceptions about changes in their relationships with pupils and approaches to teaching which are attributable to the project?*

The meaning of "intent" (i.e., intended by whom) is the focal point of this question. It appears that there are two levels of intent. The first level is that of those who developed the system. According to Dr. R. Stock (1988), DEGEM is intended to provide students with drill and practice in the areas of language arts and mathematics. It is also capable of other functions should a school be interested in other applications (e.g., typing, word processing, vocational English). She indicated that DEGEM is not intended to replace microcomputers currently found in schools (e.g., Apples, IBM's). Rather it occupies a separate niche in the school. The DEGEM computer is not used to "teach" as such, but for reinforcement and drill.

In May 1988, each school was also asked to submit a statement of intent with respect to DEGEM. Neither school had such a document at the time of request; however, both systems managers were able to draft a statement. No updates or revisions were made to these statements in 1989. Kehewin identified five objectives for the DEGEM system in the school:

1. To operate as a diagnostic tool in assessing the strengths and weaknesses of students in mathematics, English and reading.
2. To provide extensive reinforcement of teacher-taught lessons in mathematics and English.
3. To maintain specific skills in mathematics, English, and reading.

4. To provide a tool for programming and problem solving.
5. To develop skills in typing and word processing.

Onchaminahos School provided objectives under three headings:

General Objective:

1. To experiment with an advanced CAI system.

Long Term Objectives:

1. To utilize the system in the teaching of computing and programming skills.
2. To implement word processing for use in English language arts classes at the junior and senior high level.
3. To develop programs to assist in the teaching of Cree language.

Immediate Objectives:

1. To enhance teachers' effectiveness in the teaching of basic math and English skills to elementary and junior high students.
2. To objectively determine individual student levels of skills and monitor student progress.
3. To implement computer-based typing and job skills programs.

Diagnosis and complementing teacher instruction are two common functions identified by each school.

Physically, the systems are set up differently in each school. In Onchaminahos, each student terminal is set in a study carrel while at Kehewin the terminals are sitting on long tables with alternate terminals facing one side of the table or the other. In addition, at Kehewin there is a Commodore 64 in the room. In 1988, this micro was available to be used to teach specific concepts to the class before they used DEGEN for skill reinforcement. In both schools the student sessions on DEGEN are set to 10 minutes. In 1988, Kehewin blocked their classes in for 15 minutes while Onchaminahos uses 20-minute blocks. At Kehewin, students are restricted from accessing any topics which are not being taught in the classroom while at Onchaminahos the students are free to work on any topics the computer allows (by their assigned grade level). In 1989, as Kehewin had two systems managers, neither of whom was initially familiar with the systems, it appears that student use was sporadic until February 1989.

In summary, the system is intended to provide drill and practice activities to students on topics in which they have received previous instruction. It is not intended to provide instruction. A second feature of the computer systems is that it is able to diagnose student problems. The system does not provide remediation. That is the function of the teacher. These two intended uses seem to be consistent with the information provided by Dr. Stock and the two systems managers.

The information used to answer question six is qualitative and was gathered from both sites. The primary method was the teacher questionnaire which had seventy items that were related to this question. Again, the general trend of teachers agreeing more with general "motherhood" statements and less with specific focussed statements is seen.

In 1988, the teachers, administrators, and systems managers were first given a series of general questions regarding DEGEM. In 1989, the only results reported are for Onchaminahos teachers for the reasons stated earlier. All results for this section are reported in Table 10. In 1988 eight teachers returned questionnaires from Kehewin and nine teachers returned questionnaires from Onchaminahos; two administrators from Onchaminahos and one from Kehewin responded as did the system managers for each school. In 1989 a total of two individuals (teachers, systems manager, and administrators) returned questionnaires from Kehewin, and only one was completed. Therefore no useable results can be reported from Kehewin. The combined return from Onchaminahos was nine individuals. No written comments were submitted from either school.

In 1988, all groups agreed that the DEGEM system was an educational asset and that it made their job at school easier. The Onchaminahos teachers, in 1989, continued to support the concept that the system is an educational asset; however, their responses were in the *neutral* range with respect to making their job easier. In 1988 there was some support (*neutral* to *agree*) for the concept of wanting to see the system used in other core subjects; and less support for using the system with complementary subjects. In the following year Onchaminahos teachers' responses ranged from *neutral* to *disagree* with respect to core subjects and from *disagree* to *strongly disagree* in the area of complementary subjects. When asked if the computer system speeds up the learning process (1988) the responses were mixed with the teachers generally agreeing with the statement, the systems managers

strongly agreeing and the administrators generally disagreeing. The more recent results from Onchaminahos suggest that those teachers now tend to disagree with the statement. There was a significant difference between the two groups of teachers when asked if the system frustrates them, with the Kehewin teachers appearing less frustrated. The administrators indicated they were the most frustrated (*neutral to agree*), while the systems managers disagreed with the statement. The Onchaminahos group recently indicated slightly more frustration with the system. When asked whether the DEGEM computer did everything they thought it would, the groups responded in the *neutral to disagree* range with the Kehewin teachers being most positive. The 1989 results show the Onchaminahos teachers are still in the *disagree to neutral* range. When asked if there should be more DEGEM computers in the school, it appears that the systems managers and administrators favored the concept more than the teachers, and more recently the Onchaminahos teachers expressed somewhat more interest in the concept. There was general disagreement among the groups when asked if the system works the way it is supposed to all the time; however the two groups of teachers differed significantly, with the Kehewin group being the only one that agreed with this statement. In 1989 the results suggest that the teachers are more critical of the system in this area. There was also a significant difference between the teacher groups as to whether DEGEM wastes time, although the general consensus among all groups was that it does not. There has been little change in this area when the 1989 results are examined.

With respect to the teachers' impressions regarding the capability of the DEGEM system in diagnosing students' needs, when asked about the system's ability to diagnose problems, there was general agreement in 1988; however, in 1989 the teachers responded in the *disagree to neutral* range. As to which student group is most effectively diagnosed, Kehewin teachers ranked them in order as: weaker students, stronger students, and average students; with responses ranging from *disagree to agree*. In 1988 the Onchaminahos teachers ranked them in order as: stronger, weaker, and average. In 1989 they saw the ranking as: average, stronger, and weaker, with large changes in ratings for each group. In both cases (1988), the average students were seen as deriving the least benefit; whereas in 1989 this group was seen as receiving the most benefit. The Kehewin teachers tended to indicate stronger agreement to the suggestion that the DEGEM information agreed with other student data they have. The Onchaminahos teachers' responses have not

changed over time. In 1988 both groups agreed that the DEGEM information was consistent with their perceptions regarding student needs; however in 1989 the indication was that this was not the case. In 1988 they also stated that DEGEM diagnosis assisted in attending to the educational needs of the students; again however, there was a sharp drop in support for that concept in 1989. The response to, "I understand how to use the DEGEM printout to diagnose my students' needs" was *agree* in 1988; however it had dropped to *neutral* in 1989. The administrators at both schools agreed that the information from DEGEM was consistent with other information they had on the students, and that DEGEM diagnosis assists teachers in attending to the educational needs of their students. One administrator indicated that the greatest weakness regarding diagnosing student achievement is that the system does not remediate the deficit it identifies; therefore, the teacher is left to develop an individual plan.

DEGEM was also seen as enabling the teacher to provide individualized instruction for students in 1988, while in 1989 the teachers' responses were much less favorable. When asked if their students receive less individualized instruction since DEGEM's arrival (1988), both groups indicated they disagreed. In 1989 the response was unchanged. On the question, "I individualize instruction for each of my students in the regular classroom based upon the DEGEM results", the responses were in the *neutral* to *disagree* range for both years. The administrators (1988), however, indicated that they thought the system had enhanced the teachers' individualized instructional planning. The Kehewin teachers saw the system's ability to diagnose student strengths and weaknesses as approximately equal. When answering the same questions Onchaminahos teachers saw the system as being less able to diagnose strengths than weaknesses; this was the case in both years. When asked if the system could remediate student deficits there was general disagreement. There was general agreement that DEGEM provided information to assist the teacher in remediating the deficits. Again, there was little difference across time.

A series of questions were asked regarding assigning student entry levels. The 1988 responses indicated that generally, teachers saw themselves as unable to assign entry levels, yet when the computer did, there was ambivalence regarding the appropriateness. In 1989 there was a major change in that the Onchaminahos teachers indicated not only were they capable of assigning student entry levels, they

preferred to do so and had more confidence in their judgement in this area than in the computers' judgement.

Questions were asked which reflected potential changes in teaching style since DEGEM arrived. Teachers were asked if they had changed the way they teach; they responded in the negative (both groups and over time). When asked if the DEGEM system was incompatible with their teaching style, there was general disagreement at Kehewin while the Onchaminahos group tended to be and still is neutral in their response. When asked if they had less reteaching to do, both groups disagreed in 1988, and this was supported in 1989. There was a significant difference in responses (1988) to the question, "I use the DEGEM system information to determine which concepts require reteaching in the classroom" with Kehewin teachers tending to agree while the other group tended toward neutrality. This trend continued in 1989. Three questions were asked about DEGEM's ability to assist the teacher in knowing when, how, and what, to reteach. Both groups agreed that the system does not assist them in knowing how to reteach material. This was true in 1989 as well. With respect to the "when" and "what" the Kehewin teachers' responses tended toward *agree* while the Onchaminahos teachers' responses tended toward *neutral*. In 1989 the pattern for the Onchaminahos group was similar to the previous year.

The next set of questions on the teacher questionnaire dealt with the system's ability to assist in evaluating student progress. Both groups tended to agree that the system assists in evaluating student progress; however, in 1989 the Onchaminahos group was much less supportive of this concept. When asked to identify in which specific areas it was helpful, the teachers appeared to have some difficulty. With respect to assigning grades, retention/promotion, and assigning report card marks, there was general agreement that the use of DEGEM results should be limited (both groups and across time). In 1988, with respect to retention/promotion, the administrators were asked to respond to the following, "The DEGEM system results should not be used to assist in determining student retention/promotion.". Their mean response was *neutral*; however there was a large difference in the response from the administrator who also taught using DEGEM *strongly agree* and the others *disagree*. When asked if report card marks should reflect DEGEM results, administrators tended to disagree.

When teachers were asked if they used the DEGEM grade equivalent scores in determining how students were achieving, the Kehewin teachers tended to agree, while the Onchaminahos teachers tended to be more neutral. Teachers at Kehewin were less likely to use the changes in grade equivalent scores while Onchaminahos teachers were slightly more likely to use the change in scores.

The next set of questions focused on the appropriateness of courseware and the teachers relationships and interactions with the students. With respect to the appropriateness of the courseware, three areas were explored; the developmental level, the cultural needs, and the grade level. Generally, the Kehewin teachers saw the courseware as being more appropriate. Both groups indicated that the strongest area is the developmental component. This trend continued into 1989. The weakest area was seen as the cultural appropriateness of the courseware, although the Onchaminahos teachers' ratings improved in this area in 1989. Grade level ranked between the cultural aspects and the developmental level. There was a significant difference (1988) in teacher perception regarding the appropriateness of DEGEM with respect to the cultural needs of the students, with the Onchaminahos group assigning a lower value. With respect to student relationships, the teachers in both schools saw no differences in their relationships to various groups of students (stronger, average, weaker). There was a trend among the Onchaminahos teachers which continued into 1989 in that they saw their relationships with the stronger students as benefitting most. With respect to interacting more or less with students there was general disagreement that using DEGEM had any effect.

To the statement, "I present the topic in the classroom before I start my students on the DEGEM system", the teachers generally disagreed. As well, there has been no change over time. Teachers indicated (1988) that between ten and twenty percent of the students had difficulty paying attention during the 10-minute session. It appears that this may be slightly higher in 1989.

Another series of questions asked the teachers how they saw their students reacting to various features of the DEGEM system. When using the system for arithmetic, answers must be entered right to left. Teachers were asked if the students found that confusing. The Kehewin teachers responded neutrally while the Onchaminahos teachers tended to agree. In 1989, their response had moved to *strongly agree*. Both groups were asked if they thought DEGEM asked questions

differently than the texts being used. Again the same trend was seen, including the fact that the Onchaminahos scores have increased. On the issue of whether this was confusing to students, the trend held. However the Onchaminahos teachers did not see this as large a problem as last year.

There were questions asked that were unique to the administrators. When asked if DEGEM had created timetabling difficulties, all disagreed. They also disagreed that the system has caused an increase in supplementary resource materials. They agreed that the teachers perceive their computer time allotment to be adequate. There was some disagreement as to whether the advent of DEGEM has resulted in a change in teaching styles (Mean 2.0; Range 1 - 3) or whether the printouts assist in monitoring how teachers are meeting student needs (Mean 2.0; Range 1 -3).

Table 10

Mean Values of General, Diagnostic and Teacher Application Questions - Teacher Questionnaire

		1988		1989
		Keh	Onc	Onc
1.	The DEGEM system is an educational asset.	3.5	3.3	2.9
2.	The DEGEM system makes my job at school easier.	2.5	2.4	2.0
3.	I would like to see the DEGEM system used in other core subjects like social studies and science.	2.1	2.6	1.7
4.	I would like to see the DEGEM system used in complementary subject areas like art and music.	2.1	1.9	0.6
5.	The DEGEM system speeds up the learning process.	2.8	2.6	1.6
6.	The DEGEM system frustrates me.	0.6	1.9	1.8
7.	The DEGEM system does everything I thought it would.	2.4	1.5	1.8
8.	The DEGEM system is great!	3.0	2.7	1.6
9.	We should have more DEGEM computer terminals in our school.	2.0	1.9	2.3
10.	The DEGEM computer works the way it is supposed to all the time.	2.5	1.2	0.9

Table 10 Continued

Mean Values of General, Diagnostic and Teacher Application Questions - Teacher Questionnaire

		1988		1989
		Keh	Onc	Onc
11.	I think the DEGEM system wastes time.	0.4	1.6	1.4
21.	I think that the DEGEM system is able to adequately diagnose the problems my students have.	2.5	3.0	1.4
22.	The DEGEM diagnosis is adequate for my weaker students.	29.	2.1	1.1
23.	The DEGEM diagnosis is not adequate for my average students.	1.1	1.6	2.4
24.	The DEGEM diagnosis is adequate for my stronger students.	2.5	3.6	1.4
25.	The DEGEM diagnosis supports (is consistent with) other information I have on my students.	3.1	2.6	2.6
26.	The DEGEM diagnosis is not consistent with my impressions of my students.	0.9	1.6	2.8
27.	The DEGEM diagnosis helps me in attending to the educational needs of my students.	2.8	3.1	1.4
28.	I understand how to use the DEGEM printout to diagnose my students' needs.	3.1	3.1	2.0
29.	Information that DEGEM gives me on my students is not compatible with the information I get from the CTBS.	1.1	1.0	2.3
30.	The DEGEM system ranks students in the same order I do.	2.5	1.4	2.9
65.	The DEGEM system allows me to provide individualized instruction for my students.	3.0	2.6	1.5
66.	I individualize instruction for more of my students since using the DEGEM system.	2.3	1.8	1.5

Table 10 Continued

Mean Values of General, Diagnostic and Teacher Application Questions - Teacher Questionnaire

		1988		1989
		Keh	Onc	Onc
67.	In my classroom, students receive less individualized instruction now than they did prior to the arrival of the DEGEM system.	1.1	1.1	1.0
68.	I individualize instruction for each of my students in the regular classroom based upon the DEGEM system results.	1.9	1.5	1.8
69.	The DEGEM system does not assist me in diagnosing my students' strengths.	1.3	2.1	2.1
70.	The DEGEM system does not assist me in diagnosing my students' weaknesses.	1.5	1.4	1.9
71.	The DEGEM system provides me with information that allows me to remediate my students' deficits.	2.8	2.1	2.5
72.	The DEGEM system is able to remediate my students' deficits.	1.8	1.3	1.1
73.	I am capable of assigning my student's entry level tasks on the DEGEM system.	1.4	1.9	3.1
74.	When I assign the student entry level it is appropriate.	2.0	2.0	3.8
75.	When the DEGEM system assigns the student entry level it is appropriate.	2.4	2.6	2.8
76.	I prefer to assign the student entry level myself rather than let the computer do it.	1.8	1.6	2.6
77.	Since the DEGEM system has arrived I have changed the way I teach in my classroom.	1.5	1.0	0.8
78.	The DEGEM system is not compatible with my teaching style.	1.3	2.1	2.0
79.	I am using my students' DEGEM experience to enhance learning in the classroom.	2.4	2.6	2.5

Table 10 Continued

Mean Values of General, Diagnostic and Teacher Application Questions - Teacher Questionnaire

		1988		1989
		Keh	Onc	Onc
80.	Since using the DEGEM system, I have more flexibility in how I can teach.	1.8	2.0	1.6
81.	Since my students have been on the DEGEM system, I find I have less re-teaching to do.	1.8	1.7	1.3
82.	I use the DEGEM system information to determine which concepts require re-teaching in the classroom.	2.9	1.9	1.9
83.	Since the DEGEM system has arrived I am better able to know when to re-teach a concept.	2.5	2.1	1.9
84.	Since the DEGEM system has arrived I am better able to know how to re-teach a concept.	1.5	1.4	0.6
85.	Since the DEGEM system has arrived I am better able to know what material to re-teach.	2.9	2.3	2.0
86.	The DEGEM system assists me in evaluating student progress.	3.0	2.4	1.6
87.	The information the DEGEM system provides assists me when I am assigning student grades.	1.8	1.6	1.5
88.	The DEGEM diagnostic student results should be used to assist in determining student retention/promotion.	1.6	1.0	0.8
89.	The DEGEM system assists me in recording student progress.	2.4	2.0	1.8
90.	Report card marks should not reflect DEGEM system results.	2.4	3.1	3.0
91.	I change the DEGEM system parameters to change the aspects of the drill.	2.4	1.2	2.5
92.	The DEGEM courseware is inappropriate for the curriculum at the grade level I am teaching.	1.5	1.4	2.0

Table 10 Continued

Mean Values of General, Diagnostic and Teacher Application Questions - Teacher Questionnaire

		1988		1989
		Keh	Onc	Onc
93.	The DEGEM courseware is appropriate for the developmental level of the students in the grade level I am teaching.	3.0	2.1	2.4
94.	The DEGEM courseware is appropriate to the cultural needs of the students at the grade level I am teaching.	2.3	0.7	1.8
95.	The DEGEM system will enhance learning for all students in the school.	2.6	2.0	1.6
96.	Since using the DEGEM system, I find that my relationship with my stronger students has changed for the better.	1.5	2.0	2.0
97.	Since using the DEGEM system, I find that my relationship with my weaker students has changed for the better.	1.5	1.4	1.9
98.	Since using the DEGEM system, I find that my relationship with my average students has changed for the better.	1.5	1.3	1.8
99.	Since the DEGEM system has been in place I interact more with each of my students.	2.0	1.6	1.0
100.	Since the DEGEM system has been in place I interact less with each of my students.	1.4	1.1	0.6
101.	I present the topic in the classroom before I start my students on the DEGEM system.	1.8	1.4	1.4
102.	Since using the DEGEM system I find that I do not have to do as much classroom teaching on how to apply the concept.	1.8	1.6	0.8

Table 10 Continued

Mean Values of General, Diagnostic and Teacher Application Questions - Teacher Questionnaire

		1988		1989
		Keh	Onc	Onc
103.	In arithmetic, the fact that some of the answers are entered "left to right" and some are entered "right to left" confuses my students.	2.1	3.0	4.0
104.	The students in my classroom frequently exceed the limits of the DEGEM system, that is go off the high end of the scale.	1.0	1.2	0.6
105.	My weaker students are academically too weak to benefit from their time on the DEGEM computer.	1.3	2.1	1.8
106.	My average students are academically too weak to benefit from their time on the DEGEM computer.	0.9	1.6	1.5
107.	My stronger students are academically too weak to benefit from their time on the DEGEM computer.	0.6	1.1	1.3
108.	_____ percent of my students have trouble paying attention (are off task) during the 10 minute session.	1.8	2.2	2.5
109.	I use the DEGEM system grade equivalent scores in determining how my students are achieving.	2.8	2.0	1.8
110.	I use the change in grade equivalent scores reported by the DEGEM system to determine student achievement.	2.0	2.3	2.3
111.	The way DEGEM system asks questions regarding subject matter is different than the way the textbooks ask questions.	1.9	2.9	3.1
112.	The way the DEGEM system asks questions confuses many of my students.	1.8	2.4	2.4

The following section is a summary of the open-ended questions to which the teachers responded on their questionnaires. However, it should be noted that the results presented in this section are from 1988. The reason for this is that no actual teacher questionnaires were returned in 1989, only the answer sheets; therefore, no written comments were available. With respect to diagnosis, DEGEM's greatest strength is seen as "variety"; "It reinforces my perceptions"; "rank according to needs"; "gives a detailed breakdown of skills"; "pinpoints difficult areas"; "fosters speed and accuracy"; "doesn't take personalities into account". The area which caused teachers the most difficulty was "understanding the computer printout - how ironic"; "some English areas have too few questions"; "students doing harder work need help more often than students at the lower levels"; "diagnose by stanine level, ranked in Alberta"; "remembering what the symbols mean - include a legend in every printout."; "grade level equivalences are incorrect, especially in division one".

Teachers were asked to respond to several stems:

- a) *If I could change one thing about how the system is being used in this school I would . . .*: "make grade equivalences closer to Alberta norms"; "have more inservice on using results, especially over time"; "isolate each student"; "like to have access to programs in other subjects (culture, social) and have programs adapted to particular needs"; "coordinate it more closely with the textbooks we use".
- b) *The thing I do not think should be changed . . .*: "the availability of the experience"; "the ten-minute time frame"; "the system as a whole". The most useful information I get from the system is . . .: "urgency of need"; "grade-equivalent scores"; "errors over questions answered"; "diagnostic ability"; "confirmation of mastery"; "early detections of problems".
- c) *The most useful information I get from the system is . . .*: "urgency of need"; "grade-equivalent scores"; "errors over questions answered"; "diagnostic ability"; "confirmation of mastery"; "early detections of problems".

Several general comments were made: "I use the system mainly for the drill aspect." "I am very pleased with the system. It does more than I had anticipated.", "A word processing program and other useful software would help maximize student interaction.", "A better student reward system." "The system offers little feedback to students."

Following are some relevant comments from administrators and systems managers. One administrator said, "If I were to sum up the impact of DEGEM in the school, I would say that without the systems manager this system would not be functioning as effectively as it is today." One systems manager indicated that his major concern is the reliability of the terminal and terminal keypads. As well, he suggested that if a modem could be used with the system, it would assist in the area of software support.

During the structured interview with teachers, some of the same topics discussed above were covered again; however, the questions allowed for more input from the teachers. Fifteen interviews were conducted in both schools in 1988 and seventeen in 1989 (nine at Kehewin and eight at Onchaminahos). Four teachers were using the system for subjects (usually typing) other than language arts or mathematics in 1988 while three teachers (all at Kehewin) made the same statement in 1989. Ten teachers (1988) indicated DEGEM has impacted their teaching style. Nine teachers in 1989 indicated there was an impact on their teaching style. Comments indicated that it allowed teachers to focus on children's problem areas. One teacher indicated that subsequently less drill was done in the classroom.

When teachers were asked how they use DEGEM to assist in their teaching, in 1988 they responded: drill (9); diagnosis (5); review/reinforcement (4); remediation (3); and evaluation (1). In 1989 they responded drill (14); remediation (10); diagnosis (4); and reward (5). Comments ranged from positive, "I check the weekly print out, and it usually corresponds with my observation." to negative, "I don't trust it; is the readout accurate - no." Most comments were neutral to positive.

When asked how easy the system was to use (1 low and 10 high), the range was from 5 to 10 with a mean of 8.2 in 1988 and 8.4 in 1989. In 1988, one systems manager indicated that as a teacher, in terms of ease, he rated the system 8; however, as a systems manager he rated it 4.

In 1988, twelve teachers indicated that their students liked DEGEM, two said they did not, and one teacher indicated that the students used to like it but do not at this point. Twelve teachers indicated that certain students liked the system more. They indicated that it was the top students or the more studious individuals who enjoyed

it. Generally, the low functioning or inattentive students were perceived as disliking the system. In 1989, thirteen teachers indicated that certain students like the system more. Again, the comments indicated that the more able students seemed to enjoy the system better; however, one teacher indicated that the really bright children can become disinterested due to the relatively long wait between questions.

When asked whether their students benefited from their experience with the system (1 low and 10 high) the range was from 3 to 9 with a mean of 6.1 (1988). All but two teachers indicated that there are certain groups of students who benefit more. Of the thirteen who saw specific groups benefit more, ten stated the top students gained the most, two stated both the high and low ends gained the most, and one stated the high and average gained most. The range in 1989 was from 3 to 8 with a mean of 5.9 suggesting a slight downward trend. Again, the majority of the teachers indicated that there were certain groups of students who benefitted more. Their responses indicated that the better students gained the most. One teacher stated that the "good readers" derived the most benefit.

Teacher perception with respect to how the DEGEM system compares to other computer systems they may have used was explored. Teachers were first asked to rank their familiarity with computers and then to compare DEGEM to other computers they have used (1 low; 10 high). In 1988 the responses to the first question ranged from 1 to 10 with a mean of 4.9. Eight of fifteen teachers rated themselves 3 or less. In 1989 the range was from 1 to 9 with a mean of 5.1; however only four teachers rated themselves 3 or less. The responses to the second question (1988) ranged from 2 to 10 with a mean of 6.0 in 1989 and from 1 to 10 with a mean of 5.3. It would appear that generally the teachers are seeing themselves as more familiar with computers, and that DEGEM is comparing less favorably to other systems over time. It should be noted that in 1988 only eight teachers felt able to make any type of comparison while in 1989 fifteen teachers were able to do so. The pattern of the responses for those teachers is interesting. In Table 11 the first and third column indicate the rank the teacher gave to the question regarding familiarity with computers (Familiar) while the second and fourth columns indicated their responses to how DEGEM compares with other systems (Compare). Please note, that "teacher 1" in 1988 is not the same individual as "teacher 1" in 1989.

It can be seen that there is a somewhat inverse relationship between their knowledge of computers and viewing DEGEM as comparing favorably. This trend was evident in both years; however, the sample size is too small to place much meaning in this tendency. In 1988 the comments generally indicated that the most positive feature was seen as ease of use while the most negative features included lack of graphics and lack of motivating features (games). In 1989 those two issues were also raised. In addition a benefit mentioned was that students can work at their own speed and at their own level, while a drawback that was mentioned was the lack of teacher knowledge (grading system, report printout, programming).

Table 11

Relationship Between Familiarity With Computers and The Perceived Relative Value of DEGEM

1988			1989		
Teacher	Familiar	Compare	Teacher	Familiar	Compare
1	3	9	1	1	8
2	3	8	2	2	5
3	3	9	3	2	5
4	5	2	4	3	1
5	7	10	5	4	5
6	7	2	6	4	6
7	8	6	7	5	9
8	10	2	8	5	10
			9	5	5
			10	6	3
			11	6	8
			12	8	8
			13	8	3
			14	9	2
			15	9	1

Teachers were asked to rate the impact of DEGEM on their students' learning. In 1988 the scores ranged from 3 to 10 with a mean of 5.6. Eight of the fourteen teachers who answered this question rated DEGEM 5 or less; six rated it 6 or more. In 1989 the range was from 2 to 10 with a mean of 6.2 and only seven of the seventeen teachers rated it 5 or less. In 1988 the final comments appeared equally split. Two teachers indicated that, "It is a waste of money - get rid of it." and two teachers indicated that, "It's a fantastic system; I don't want to be without it." The rest of the comments were in between, generally reflecting the thinking that the system has more potential than is being utilized. In 1989 of the thirteen teachers who made comments, only four made any positive comments. They tended to be quite general, (e.g., helps in reading, seems to meet needs, its a great machine, I like it for what I use it for, depends on the class). The negative comments were sometimes more specific and intense (e.g., I do not like it, useless in reinforcing, uses outdated technology to operate outdated software that is founded on outdated pedagogy). Three individuals indicated that there was a need for inservice.

DISCUSSION: QUESTION SIX

The qualitative data required to answer this question were gathered from both sites. In 1988 it was determined that the intent of the system was to provide drill and practice activities to students on topics in which they have received previous instruction. As well, the system is intended to diagnose, not to provide remedial instruction.

The stakeholders generally indicated that they liked the system and wanted to continue to use it. As well, teachers generally agreed that the system was able to diagnose students' areas of need, and that it provided them with information which allowed for individualized instruction. However, most indicated that they did not use the information collected in any specific way, including its application to individualized instruction. Entry level tasks were not assigned by teachers. In all cases the computer assigned the entry level. Further it appears that in 1989 that the popularity of the system at Onchaminahos is waning. As well there appeared at both schools an increased desire on the part of the teachers to receive additional inservice, which was not provided.

Most teachers indicated that they have not changed the way they teach since the arrival of DEGEM and they do more reteaching now. DEGEM appears to assist teachers in knowing "what" and "when" to reteach; however, it does not seem to help in the area of "how" to reteach. Both groups agreed that DEGEM results assist in evaluating students' progress; however, there were no clear specific areas where there was agreement in how the results should be applied. It was clear however, that teachers preferred not to see the results used in determining report card marks or assist in deciding retention/promotion. It is interesting to note that this perception was not generally shared by administration.

The courseware seems more appropriate for the developmental level and the grade level of the students; however, teachers did not see it as culturally appropriate, especially at Onchaminahos. These views remained stable at Onchaminahos in 1989. With respect to the issue of changing relationships with students, teachers generally saw no change, except perhaps at Onchaminahos where teachers indicated that they had a more positive relationship with the stronger students. Neither group saw the system having any effect on the amount of time they spent interacting with students.

One interesting trend emerged during the structured interviews. There seems to be an inverse relationship between knowledge of computers and positive orientation toward DEGEM. That is, the more individuals knew about computers, the less they liked DEGEM. This seemed to be consistent in both 1988 and 1989, although it was perhaps stronger in the first year. It would therefore appear that the more computer literate a teacher is (i.e., exposure and use of other systems), the less likely the teacher is to indicate that the DEGEM system compares favorably. If however, the teacher has little or no experience with computers, the DEGEM system is perceived as an excellent system.

Question Seven - *To what extent are students assigned to the DEGEM CAI Program able to use the courseware as intended? Do they appear to benefit from the feedback provided? Is time on task adequate? How long does it take for students to become proficient on the system? What do pupils perceive to be the relative merits of this version of CAI and conventional instruction? How do pupils perceive that relationships with teachers have altered as a consequence of the CAI program experience?*

The methodology used to answer this question was similar to question six. Questionnaires were administered to students in both schools; grades 3 to 7 at Onchaminahos and grades 3 to 8 at Kehewin. These questionnaires had a Likert-type scale using the same rating as for the teachers. The data will be reported in the same fashion with the Kehewin students' means first, and the Onchaminahos students' means second. As well, there was an opportunity for students to respond to some open-ended questions. In 1988, eighty nine students responded from Kehewin school and one hundred and nine from Onchaminahos. Between five and ten students did not respond to any given item. For some questions the non-responses would rise as high as forty to fifty. Usually, however, these would be related to items which were subject specific and one-half of the students at Onchaminahos would not be involved with DEGEM for that subject. In 1989, the number of students who commented was significantly lower, with 53 students, grades three to eight, from Kehewin and 32 students, grades three to seven, from Onchaminahos responding. The grade two and three students were given a questionnaire where the agree-disagree continuum was represented by happy-unhappy faces. These results were later transcribed into numerical values. For children in grades four and up the responses were recorded numerically. In 1988, this was followed by a structured interview with a small sample of students (n=33) selected from grades two through six.

Generally, the student responses were quite positive. It is noteworthy, however, that on questions where teachers or others rated the students as having difficulty or disliking an aspect of the system, the students still gave the system high marks. Of the forty-four questions asked of students (1988) , there was a statistically

significant difference between the two groups on fourteen items or approximately thirty-one percent ($p < 0.05$). In 1989, there was a significant difference between the schools on sixteen questions or approximately thirty-six percent of the total items.

The students were first given a series of general questions regarding DEGEM. They indicated that DEGEM helps them learn and that it made their job at school easier. Both groups wanted to see the system used in other core and complementary subjects. Although both groups saw the computer as helping them learn faster, there was a significant difference in favor of the Kehewin students. When asked whether the DEGEM computer did everything they thought it would, the answers were positive but lower than most other responses. Both groups agreed that there should be more DEGEM computers. However, the Kehewin students were much more positive than the Onchaminahos students, whose agreement with this statement dropped slightly over time.

Students were asked specific questions regarding their own perceptions of achievement. Both groups indicated mathematics was easier since DEGEM arrived, with the Onchaminahos students' responses becoming more positive over time. As well, there was agreement that reading was easier, with Kehewin students agreeing more strongly with this statement. According to the students, both mathematics and reading are more fun on the DEGEM computer.

The balance of the questionnaire offered a range of general questions. Both groups enjoyed working on the system. There was agreement that the system was easy to use, made learning fun, and that they would like to work on the computer more often. Again, on all three questions there was a statistically significant difference between groups with the Kehewin group scoring higher. There was agreement that the DEGEM computer helps students learn mathematics better than the mathematics class alone. As well, students agreed, although less strongly, that the DEGEM computer helps them learn language arts better than the language arts class alone. When asked to respond to, "What I learn on the DEGEM computer helps me learn in the classroom.", the respondents agreed, with the Onchaminahos students' response becoming more positive over time. In response to, "The DEGEM computer helps me learn my school work." the Onchaminahos students' became slightly more positive over time. When asked if they needed help from their teacher when on the system, Kehewin students indicated that this was generally not the

case. The response of Onchaminahos students' suggested that, over time, the students required more teacher assistance while working on the DEGEM computer. Students from Kehewin disagreed with, "I like learning in the classroom better than in the DEGEM computer room.", although the Onchaminahos students' were more neutral on this issue. Both groups indicated they thought the computer helps them understand their mistakes, tells them when they are wrong, and how they are doing. Few admitted to wasting time when on the system or that it was hard to learn how to use the system. When asked if they got along better with their teacher since using DEGEM, they responded in the mild affirmative. When asked, if when they got stuck did their teacher help them, both groups agreed. Both groups indicated that when they made a mistake on the computer they needed their teacher to help them understand where they went wrong. When asked if ten minutes was too short, they agreed. On the issue of whether they were confused when the computer asked them to enter an answer right to left (e.g., DEGEM requires the number "15" to be entered "5" then "1"), their responses were neutral to affirmative, with Onchaminahos students agreeing much more strongly than Kehewin students.

Both groups indicated that when they get an answer correct the computer lets them know in an interesting way. Kehewin students agreed that the graphics are as good as other computers, with Onchaminahos students being less positive. There was agreement that the DEGEM system asks questions differently than textbooks, yet they indicated that this did not confuse them.

Table 12

Mean Values of Questions on The Student Questionnaire

	1988		1989	
	Keh	Onc	Keh	Onc
1. The DEGEM computer helps me learn.	3.5	3.2	3.3	3.2
2. The DEGEM computer makes my job at school easier.	3.2	2.9	3.2	2.8
3. I would like to see the DEGEM computer used in other core subjects like social studies and science.	3.2	3.0	3.5	3.0

TABLE 12 Continued

Mean Values of Questions on The Student Questionnaire

	1988		1989	
	Keh	Onc	Keh	Onc
4. I would like to see the DEGEM computer used in complementary subject areas like art and music.	2.9	3.2	3.4	2.9
5. The DEGEM computer helps me learn faster.	3.2	2.4	3.1	2.8
6. The DEGEM computer bugs me.	0.8	1.5	1.9	1.4
7. The DEGEM computer does everything I thought it would.	2.4	2.3	2.5	2.0
8. The DEGEM computer is great!	3.5	3.3	3.5	2.8
9. We should have more DEGEM computers in our school.	3.4	3.1	3.5	2.9
10. The DEGEM computer works the way it is supposed to all the time.	3.1	2.3	2.5	2.4
11. I think the DEGEM computer wastes time.	1.3	1.5	1.4	1.8
12. Math is easier for me since I have been using the DEGEM computer.	3.2	2.8	3.1	3.3
13. Reading is easier for me since I have been using the DEGEM computer.	3.2	2.9	2.9	2.8
14. Math is more fun when I use the DEGEM computer.	3.1	2.8	3.5	3.2
15. Reading is more fun when I get to use the DEGEM computer.	3.1	2.8	3.3	2.8
16. I like to work on the DEGEM computer. I find the DEGEM computer computer easy to	3.6	3.3	3.3	3.3
17. use.	3.5	3.0	3.5	3.3
18. I find learning on the DEGEM computer fun.	3.5	3.1	3.4	3.0
19. I would like to work on the DEGEM computer more often.	3.6	3.1	3.6	2.9
20. The DEGEM computer helps me learn math better than my math class alone.	3.1	2.9	3.2	3.1
21. The DEGEM computer helps me learn language arts better than my language arts class alone.	2.9	3.1	2.6	2.8

TABLE 12 Continued

Mean Values of Questions on The Student Questionnaire

	1988		1989	
	Keh	Onc	Keh	Onc
22. The DEGEM computer helps me learn my school work.	3.3	2.8	3.3	3.0
23. What I learn on the DEGEM computer helps me learn in the classroom.	3.1	2.6	3.2	3.2
24. I need help from my teacher when I use the DEGEM computer.	1.7	1.5	2.1	2.2
25. I like learning in the classroom better than in the DEGEM computer room.	1.4	1.4	1.5	2.2
26. I find the questions on the DEGEM computer too hard.	1.3	1.5	2.1	1.4
27. The DEGEM computer helps me understand my mistakes.	3.2	3.1	3.1	2.8
28. The DEGEM computer tells me when I'm wrong.	3.3	3.1	3.4	3.1
29. The DEGEM computer tells me how I'm doing.	3.5	3.4	3.3	3.2
30. When I'm supposed to be working on the DEGEM computer I waste time.	1.6	1.5	2.0	2.0
31. It was hard for me to learn how to use the DEGEM computer.	1.6	1.7	1.4	1.7
32. I understand why my teacher has me using the DEGEM computer.	3.0	2.9	3.3	2.8
33. I get along better with my teacher since I have been working on the DEGEM computer.	2.6	2.7	2.8	2.6
34. I learn better in the classroom since I have been using the DEGEM computer.	3.0	2.6	3.2	2.7
35. When I get stuck on the DEGEM computer my teacher helps me.	3.3	2.9	2.9	3.1
36. When I make a mistake on the DEGEM computer I need my teacher to help me understand where I went wrong.	2.8	2.4	2.8	2.8

TABLE 12 Continued

Mean Values of Questions on The Student Questionnaire

	1988		1989	
	Keh	Onc	Keh	Onc
37. Ten minutes is too short a time to be on the computer.	2.7	2.6	3.0	2.9
38. In math, sometimes the answers are entered "left to right" and sometimes they are entered "right to left". This confuses me.	2.5	2.0	2.6	3.0
39. When I am using the DEGEM computer I find it doesn't work properly.	1.7	1.9	2.0	2.3
40. When I get a question right the DEGEM computer lets me know in an interesting way.	3.3	3.2	2.9	3.2
41. The DEGEM computer graphics are as good as other computers.	3.1	2.8	3.4	2.7
42. The fact that the DEGEM computer terminal screens use green only, rather than several colors, disappoints me.	2.3	1.7	2.5	3.1
43. The way the DEGEM computer asks questions about school subjects is different than the way the textbooks ask questions.	3.1	2.8	2.7	3.2
44. The way the DEGEM computer asks questions confuses me.	1.8	1.7	2.4	2.0

In 1988, there were a number of students who wrote comments, as they were invited to do so; in 1989, fewer students wrote comments. The comments were generally quite short and revolved around several themes which will be reported by division. In 1988, division one students perceived the computer as helping them learn (35); that they liked using it for the subject(s) they had (31); that it was fun (11); that they like typing (9). In 1989, the division one students commented that the computer helped them learn (9), that they liked using the computer for math (5),

and that it was fun (5). For division two students (1988), there were similarities in that DEGEM was perceived as helping them learn (35) and that it was fun to use (25); however, they also commented that it "breaks down a lot" (23) and they would like a color screen (15). In 1989 this student group indicated that the computer helps them learn (13); it keeps them busy (6); they enjoy the games (5); and they like the feedback (3). This older group was more critical of the system and commented on the following: sometimes it does not work (8); would like more color and graphics (6); it does not give feedback when one or two errors are made (6); and that working on the computer was boring (5). They spontaneously commented that they would like more time on the computer (6), they would like to use it for more subjects (11), and they would like more games (4).

The results of the structured interviews (1988) were similar in that any general comments made were brief. When asked if they liked working on the DEGEM computer, thirty answered "yes", and three answered "no". "It helps you learn", and "It's fun", were the two most popular responses. When asked to, "Pick a number that tells how much you like the DEGEM computer" the responses ranged from one (n=2) to ten (n=17) with a mean of 8.2. When asked how often they used the system each week, about one-half were able to indicate the frequency with any degree of accuracy. When asked if they had enough time on the computer, ten indicated "no" while twenty-three indicated "yes". When asked what the best thing about the DEGEM system is, students indicated: that it helped them learn (7); it was fun (5); it was easy to use (4); and they liked typing (4). When asked what the worst thing was, they said: when I get the questions wrong (6); when it breaks (4); the subject I take (e.g., mathematics, reading) (4). Finally, the students were asked, "If you could make one wish about the computer, what would it be?" The answers were interesting and creative - play games (7); spend more time on it (5); that I would get all right (3); that it would not break (3); have color (2); it would talk (2); it would play rock music (1); that I could have my own (1).

The final area that was investigated, in 1988, was time on task. The procedure used to gather data involved selecting a number of students at random. They were observed both in the classroom and on the DEGEM system. Complete observations were conducted on twenty-two students at Kehewin and twenty students at Onchaminahos. Four students were observed at each grade level (grades 2-7 inclusive at Kehewin; grades 2-6 inclusive at Onchaminahos). Two

students were dropped from the sample at Kehewin due to incomplete data. The procedure involved observing a student in the classroom and then observing the same student in the same subject area on the DEGEM system. Observations were made at 10-second intervals for five minutes (thirty observations) in the classroom, and the same measures were made on the DEGEM system (total observations were sixty). Observations were made by two individuals who were trained to using a 4-point rating scale, as follows:

<u>Score</u>	<u>Description</u>
1	Student is actively engaged in learning (i.e., there is some observable component which indicates engagement - writing, pushing a button, talking to the teacher).
2	Student is oriented toward learning (i.e., there is no observable evidence of engagement, but the student is oriented toward the learning activity - looking at the teacher, looking at the computer screen).
3	Student is disengaged or off task (i.e., there is some observable component which indicates off task behavior - playing with a toy, reading a book when should be writing talking to classmates).
4	This option was to be used if the observer could not decide on a category; it was never used.

The sixty observations for each student, were combined to yield a total of ten observations per student, (i.e., six 10-second observations were averaged to yield one observation one minute in length, giving a total of ten observations). Therefore, the data analysis was conducted on ten measures; five "in-class", and five "on-DEGEM" observations, with each observation representing one minute. The data were analyzed in two directions: within schools - class by DEGEM; and between schools - class by DEGEM.

Within schools, each minute of in-class behavior was compared with each minute of on-DEGEM behavior for the total number of subjects in the school. As well, the average of the in-class observations (five minutes all subjects combined) was compared to the average of the on-DEGEM behaviors (five minutes all subjects combined). A single factor (time on task) analysis of variance (ANOVA) with repeated measures (twelve observations) was run "within schools". There was no statistically significant difference between time on task in-class or on-DEGEM in

either school. Onchaminahos' results yielded an F Ratio of 1.24 with a probability of 0.28. Kehewin's results yielded an F Ratio of 1.28 with a probability of 0.27.

When the average time on task figures for in-class and on-DEGEM were compared for each school, no statistically-significant results were indicated. Onchaminahos' results showed a mean difference of 0.10 (little difference, but favoring on-DEGEM time on task), yielding a probability of 0.92. Kehewin's results showed a mean difference of -1.33 (a small difference, but favoring in-class), yielding a probability of 0.20.

As can be seen from all the results, there are no statistically significant differences between in-class and on-DEGEM time on task behaviors in either school. There appears to be a modest trend which would indicate that students at Onchaminahos are on task more when using DEGEM; and Kehewin students are on task more when in class.

Between schools, each minute of in-class behavior in one school was compared with the same minute of in-class behavior in the other school. The same comparison was made for the on-DEGEM behavior. As well, the average of the in-class observations (five minutes all subjects combined) was compared to the average of the on DEGEM behaviors (five minutes all subjects combined). The results are reported in Table 13. As can be seen from the results, there is a statistically significant difference between schools in both the in-class and on-DEGEM time on task behaviors ($p < 0.05$). In both cases the Onchaminahos School obtained higher mean scores. When considering the average value of the five minutes of observation, the Kehewin students appeared to be on task more, in both the in-class and on-DEGEM settings.

Table 13

Comparison of Time on Task By Minute In-Class and On DEGEM Between Schools

Minutes	Means		Standard Deviation		T	Prob. 2-Tail
In-Class						
	Onc	Keh	Onc	Keh		
1	1.51	1.75	0.47	0.51	-1.6	0.12
2	1.41	1.80	0.41	0.60	-2.5	0.02
3	1.64	1.87	0.51	0.59	-1.41	0.18
4	1.64	2.10	0.41	0.63	-2.8	0.01
5	1.59	2.01	0.51	0.68	-2.3	0.03
Ave.	1.56	1.90	0.31	0.44	-3.0	0.01
On-DEGEM						
	Onc	Keh	Onc	Keh		
1	1.74	1.73	0.42	0.47	0.0	1.00
2	1.69	1.91	0.49	0.51	-1.41	0.16
3	1.69	2.00	0.42	0.52	-2.1	0.04
4	1.59	2.00	0.23	0.55	-3.2	0.00
5	1.58	1.83	0.39	.047	-1.8	0.02
Ave.	1.66	1.89	0.22	0.40	-2.4	0.02

DISCUSSION: QUESTION SEVEN

The qualitative data required to answer this question were gathered on-site from both locations through questionnaires and structured interviews. The students' responses were on the whole, quite positive, with the Kehewin students being generally more positively oriented toward the system and the Onchaminahos students' responses becoming slightly more positive over time. The most likely explanation for this has to do with the system malfunction at Onchaminahos discussed in detail in Question Four. However, the 1989 results were also

indicative of some dissatisfaction regarding the reliability of the system at both sites. The division one students were less critical of the system than the division two students.

Students indicated that feedback from the computer was given in an interesting way, yet several indicated in written comments, that they wished there was more variety in how the computer responded to them. Further, some students indicated that the computer's feedback sometimes confused them and that they would like feedback when they made only one or two errors. As well, teachers expressed some concern over the way feedback was provided. Generally, students indicated that the system was easy to use and that they were able to understand the system requirements almost immediately. They indicated they thought they learned better with CAI than in the classroom alone, yet no rationale was offered. It could simply be that they enjoy the opportunity to work on the system or a change from classroom routine. They indicated modest improvement in their relationships with teachers. However, given that their responses to other questions were generally stronger, one would not expect that relationships have not changed much. They also indicated that when they were stuck they needed their teacher to help them find where they made the mistake.

General comments requesting color terminals, or more games or game-type formats, were common. As well, many students suggested an interest in using the computer in other subject areas. Therefore, it appears that students enjoy using the system but have some areas where they would like to see modifications. However, a few of the older students indicated that they did not like working on the DEGEN computer and found it boring.

The time on task data used a sample of forty-two students who were observed individually for five minutes in the classroom and five minutes on DEGEN. No statistically significant differences were found between time on task in the class and time on task while on DEGEN. Therefore it would appear that, in this case, the use of the system makes little difference when time on task is compared to the classroom.

QUESTION EIGHT - *To what extent is the DEGEM CAI hardware/software configuration suitable for instruction in the Alberta context? How does cost per student- instructional hour compare with conventional teaching and other hardware systems? How reliable is the system in terms of downtime? How adequate is vendor support in terms of technical training, maintenance, modifications and updates? Of what utility are the authoring and support components of the system? How flexible and adaptable is the system to change?*

This question has presented itself as one of the most difficult to answer. During the first round of data collection several difficulties were encountered. First, accurate cost figures were difficult to obtain or determine. As well, no records had been kept with respect to computer down time. Consequently, what remains were the impressions of teachers, students, and systems managers. Regardless, data which has been acquired during the first round of data collection will be reported. Sources of the data will be identified as appropriate. The questionnaires provided the perspectives of some of the stakeholder groups in a qualitative format. Quantifiable data were harder to collect (e.g., on-going costs, number of users, number of hours of use). When the interim report was submitted one of the areas that was discussed was the need for more accurate record keeping in this area; however, when the second round of data collection occurred, it was discovered that no information that would assist in answering this question more fully had been recorded. Table 14 reports the responses of the teachers to the questions which relate to this topic. As was stated earlier, the Steering Committee indicated that given the number of staff changes during the 1988-1989 school year, the systems managers and administration would be given the teacher questionnaire. Therefore, only during the 1988 data collection are there any specific responses from systems managers and administrators.

This section will begin with a summary of the qualitative data. With respect to the issue of hardware and software, several questions were posed to teachers, administrators and systems managers. When asked if the mainframe crashes frequently, the responses were in the *strongly disagree* to *disagree* range in 1988, with the Kehewin teachers' responses being significantly lower (i.e., more

favorable). The systems managers' responses were similar to the teachers' responses in their own schools. In 1989, the Onchaminahos teachers' impressions were slightly more favorable than in 1988. When asked how the detachable keyboards functioned, in 1988 the teachers reported that they worked well, with the Kehewin teachers' results being more favorable. It is interesting to note that the systems managers indicated that the keyboards did not function well. In 1989 the Onchaminahos teachers' impressions of the keyboards changed in that they now see them as not functioning well. When asked the same question regarding the terminals, the same trends were apparent both between the groups in 1988 and across time at Onchaminahos School. In 1988 when administrators and systems managers were asked if they thought DEGEM hardware often requires maintenance, there was a large difference between their answers. The administrators indicated that very little maintenance was required, while the systems managers indicated that the system often requires maintenance.

In 1988, when the teachers and systems managers were asked if the software appeared to be outdated, there was general disagreement with the statement. However, there was a significant difference between the two teacher groups, again with Kehewin teachers being more supportive. In 1989, the Onchaminahos teachers indicated that they now agree with that statement. With respect to being unable to run language arts and mathematics at the same time, the groups' responses were generally neutral in 1988. In 1989, teachers report that it is a disadvantage.

When in 1988, teachers were asked if there were language arts or mathematics topics they wished the system dealt with, their responses were generally *neutral* to *slight agreement*. In 1989 there is now definite agreement with the concept. In both years the teachers have indicated that additional topics should be added at some point. The systems managers indicated the program may allow for the addition of new topics, but when asked if it would be easy to do, they responded with *strongly disagree*. When asked if the system provided adequate reinforcement for students, there was a significant difference between the teacher groups, with the Kehewin response being *agree* to *strongly agree* and the Onchaminahos group being generally *neutral*. Since that time the Onchaminahos teachers have moved from a *neutral* position to a *disagree* position. The same significant difference was found (1988) when asked if the green screen (versus color) affects student motivation.

Again, in 1989 the Onchaminahos group moved closer to the *disagree* end of the continuum. When asked if the graphics were as good as the graphics on other computers, both groups agreed that this was not the case (1988), and in 1989 there is less satisfaction with the lack of graphics.

The systems managers (1988), when asked if they frequently found errors in the software, indicated not often. They also indicated that they were able to handle most of the system's problems. They suggested that they spend a lot of time fixing the system's problems and that vendor support for software is better than the support for hardware; however, support for trouble shooting was seen as the strongest of the three areas. There was some question whether the supporting documentation for the system was adequate and both indicated that they do not use the authoring features of the program.

Only three questions were directed to students regarding the reliability and technology of the DEGEM system. "When I am using the DEGEM computer, I find it doesn't work properly" yielded results in the *disagree* to *neutral* range (for Onchaminahos and Kehewin respectively, 1988). In 1989 the responses were *neutral* to *slightly* agree. When asked if the system works the way it is supposed to all the time, in 1988 Kehewin students indicated general agreement while the Onchaminahos students tended toward neutrality. However, in 1989 both groups responded to this statement in the *neutral* to *agree* range. There was a significant difference in the response to, "The fact that the DEGEM computer terminal screen uses green only rather than several colors disappoints me." with Kehewin students expressing more disappointment. The 1989 results show the Onchaminahos students expressing greater disappointment.

Table 14

Mean Values of Software and Hardware Questions - Teacher Questionnaire

	1988		1989
	Keh	Onc	Onc
113. There are topics in language arts I wish the DEGEM system dealt with.	2.3	1.8	3.3
114. There are topics in mathematics I wish the DEGEM system dealt with.	2.3	2.0	3.1
115. Additional topics should be included in the DEGEM system at some point.	2.9	2.3	2.8
116. My students move more quickly through the topics than I expected.	2.0	1.8	1.5
117. When I am using the DEGEM computer I find it does not work properly.	1.3	1.9	2.0
118. When I take my class to work on the DEGEM computer I find the whole system (mainframe computer) is not working.	0.4	1.6	1.4
119. When I take my class to work on the DEGEM computer I find the detachable keyboard is not working.	0.8	1.9	2.6
120. When I take my class to work on the DEGEM computer I find the student terminal (including the keys) is not working.	1.1	2.1	2.4
121. The DEGEM software appears to be outdated.	0.7	1.4	2.9
122. Being unable to run the language arts program and the math program at the same time is a disadvantage.	2.3	2.0	3.1
123. The DEGEM computer provides adequate reinforcement for my students.	3.6	2.0	1.1
124. The DEGEM system graphics are as good as other computers.	1.4	1.3	0.8
125. The fact that the terminal screens use green only, rather than several colors, does not affect my students' motivation.	3.2	1.6	1.1

In 1988, several attempts were made to obtain data regarding the initial and ongoing costs of the system. Requests were made at several levels - school, band council, government, and Innovative Technologies in Education Inc., the supplier. Indian and Northern Affairs Canada was able to supply the initial system costs (dated on or about October 1986). They are outlined in Table 15:

Table 15

Initial DEGEM System Costs in Canadian Dollars

Central Blue Quills System (currently at Onchaminahos School)

Hardware (24 terminals)	\$ 95,000.00	
Software	\$ 8,000.00	
Courseware	\$ 33,500.00	
Programming Languages	\$ 5,000.00	
Authoring Programs	\$ 6,500.00	
Shipping and Installation	<u>\$ 5,000.00</u>	
	Sub-Total	\$ 153,000.00

Satellite System (currently at Kehewin School)

Hardware (24 terminals)	\$ 95,000.00	
Software	\$ 8,000.00	
Courseware	\$ 25,000.00	
Shipping and Installation	<u>\$ 5,000.00</u>	
	Sub-Total	\$ 133,000.00

Services

Teacher Training	\$ 5,000.00	
Technicians Training	\$ 5,000.00	
Systems Manager Course	\$ 4,000.00	
Spare Parts	<u>\$ 18,000.00</u>	
	Sub-Total	<u>\$ 32,000.00</u>
	Total Project	\$ 318,000.00

A request was made of Innovative Technologies in Education Inc. to supply current prices for an identical system. A 1988 price list was received; the only listing for a system which supplies 24 DEGEM terminals was the EX-48. The cost for this system is \$75 500.00 U.S. This does not include the DEGEM keyboards which are \$158.00 U.S. each. The prices appear to be:

	<i>U.S Dollars</i>	<i>Canadian Dollars (@ 1.22)</i>
Hardware (24 terminals)	\$ 75,500.00	\$ 92,110.00
Keyboards	\$ 3,792.00	\$ 4,626.24
Line Voltage Regulator	\$ 4,100.00	\$ 5,002.00
Spare Parts Kit	<u>\$ 24,000.00</u>	<u>\$ 29,280.00</u>
Total	\$ 107,392.00	\$ 131,018.24

The reason a current price list was requested was there was some indication in 1988 that prices had declined recently. Initially, it appears that the terminal prices have dropped; however, when the costs of the keyboards are included the price is about the same. Spare parts have increased and there is no indication of prices regarding software, courseware, inservicing, or installation. Therefore, it is not possible at this time to accurately compare the original cost to a current price for the same system. It does appear, however, that costs have not decreased, and, in fact, may have increased slightly (with respect to Canadian dollar equivalents). In 1989, Tammy Williams, the production manager with Innovative Technologies in Education, indicated that there has been no price change with respect to the DEGEM system since 1988. Therefore the only impact on price would be the relative value of the Canadian dollar to the U. S. dollar.

There was some indication that an annual service contract was available at a cost of between \$ 10,000.00 and \$ 12,000.00, and that one or both school(s) has purchased one. However, no agency was able to supply any written documentation to that effect. Therefore, the exact cost is not known, nor is it known whether the amount is in Canadian or U. S. dollars, or what the service contract includes. If either school has entered into this sort of agreement it would affect the cost effectiveness figures.

In 1988 the schools were also asked, if possible, to supply costs of items such as paper, back-up tapes, and hidden labor costs (i.e., time spent by the systems

manager over and above any allocated release time). Onchaminahos School was able to do so, and estimated an annual cost of about \$ 400.00 per year for supplies. Labor was estimated at approximately four hours per week for forty weeks. Labor could then be calculated at a 0.1 f.t.e. teaching position or about \$ 3,000.00 (assuming an average teaching salary of \$ 30,000.00). This would yield an annual cost of about \$ 3,400.00. However, it should be noted that no records appear to have been kept; therefore, the four-hour-per-week figure is only a rough estimate, as is the cost of materials. This, combined with the fact that data such as the number of student-hours on DEGEM were not available, results in an inability to calculate figures such as cost per student instructional hour. As well, since no known official records are kept, no "hard data" can be obtained with respect to issues such as downtime or maintenance costs. It should be noted that no similar information was supplied, though requested, for 1989.

In 1989 there was also some suggestion that Innovative Technologies in Education was no longer marketing the DEGEM system and that they were concentrating on supplying educational software for IBM computers. In discussion with Tammy Williams, she indicated that in fact there was every intention to continue to market the DEGEM system. She also indicated that in terms of investment of time there was an even split between DEGEM and the IBM software.

DISCUSSION: QUESTION EIGHT

Some qualitative data and less quantitative are available from both schools. No records appear to have been kept (1988 or 1989) with respect to downtime, vendor support, or hardware repairs. Therefore, an attempt was made to obtain the data from the stakeholders in a qualitative format.

The two teacher groups often disagreed on the reliability of the system in 1988, due no doubt, to their differing experiences in the spring of 1988. Generally, the impressions were that the system functioned well, barring the one major crash at Onchaminahos. This was, in spite of the fact, that one or more terminals appeared to always be out of service in each school. It appears that the mainframe is more reliable than the terminals, especially the key pads. It is also noteworthy that the

teachers' impressions at Onchaminahos, with respect to the reliability of the hardware, have worsened somewhat over time.

From the students' perspective, from 1988 to 1989, both groups indicate that the system appears to be less reliable. As well they expressed disappointment at the limitations in the areas of graphics and the use of color. It also appears that even in areas where the Kehewin students' views are remaining relatively stable, the Onchaminahos students are expressing greater disappointment.

The authoring component appears not to be used at all, and according to the two systems managers, the system is not particularly flexible. The modification and addition of programs is seen as quite difficult.

It appears that the initial cost of the two twenty-four terminal systems was about \$318,000.00 Canadian. It does not appear that the replacement costs would be significantly different at this time ; although not all figures were available to make direct comparisons. Few other cost figures were available; therefore, cost per student instructional hour cannot be calculated.

Reinhold (1986) discusses the issue of networked microcomputer systems versus minicomputers (such as DEGEM). She indicates that one of the advantages of having networked micros is that when the main system is off, additional software can be run at each individual station. Such is not the case with DEGEM. She does indicate, however, that at least two vendors of other mini-systems are providing that capability. With respect to the similarities and differences between minis and networked micros she indicates that both use a hard drive system which allows students to access different parts of the program simultaneously. She refers to Randy Lough speaking about the Dolphin minicomputer system. He says minis, "provide more extensive processing power, and faster response time. . .users can maintain more extensive records." (p. 43). Tom Seal, discussing networked IBM's states, "users can use other software than [that] designed for the ILS [Integrated Learning System] . . . distributing processing power among several users [of micros] . . . slows students' response times . . . networks [are] more powerful than mini-based systems." (p. 44).

Reinhold goes on to compare four ILS systems, DEGEM being one. She quotes a price of \$90,000.00 to \$100,000.00 (U.S.) for 32 terminals, a printer, two software packages, installation, two days of teacher training, and three days of systems manager training (p. 47). Prices are listed for the other systems, but as different hardware is provided direct comparisons are difficult. In terms of deployment CCC Microhost has 1300 systems in use; Plato/Wicat, 150; Dolphin, 75; and DEGEM, 300 (world-wide, others gave U. S. figures).

Should the reader require more detail on networking micros the May 1988 issue of A+ magazine, is an issue totally dedicated to the networking of micro computers (specifically Apples).

Some of these issues need to be explored in more detail, at some point, before a determination can be made as to the cost effectiveness of the DEGEM system. The magnitude of the work required, renders this a study of its own. However, the literature reviewed in this area clearly indicates there are a wide range of options that require exploration. This should be occur prior to any decisions regarding choosing a system is made.

QUESTION NINE - *Does the DEGEM CAI result in improvement in student achievement in reading and math when applied in special education contexts?*

To answer this question, a case study approach was used as no consistent data were available on any special education class. That is, no special education classes identified as falling within the scope of this study, had any standard assessment data across its student members. To meet the conditions of this study a class had to be segregated at least for part of the time, the students had to be between grades two and seven inclusive, and using the system. During the 1987-1988 school year, only one class met this requirement. It was located at Onchaminahos School. During the 1988-1989 academic year this school reorganized its special education classes. As a result of the reorganization there were no special education classes which fell within the scope of this study.

The format used here will be similar to that outlined in question three. One student was selected from the special education class, and an individual diagnostic profile was written for the student from both the DEGEM and the CAT perspectives. The profiles were then compared. Only one student was chosen, as in the one particular class eligible to be included in the study, only five students had completed more than twelve sessions on the DEGEM system (i.e., were past the testing phase). Of those five, three had already been dropped a level on at least one topic.

CASE D

The student selected for discussion was chosen from the elementary special education class (grades 3 to 6) at Onchaminahos School. J.L. is a female student in this class whose current grade placement is grade 5.

J.L. wrote the Canadian Achievement Test, Level 12 in May 1988 (Grade Level 2.8). Her grade equivalent score on the Total Test Battery was 2.1. For the purpose of this discussion, only the mathematics section of the CAT will be considered. The CAT results for J.L. are reported in Table 16:

Table 16

J.L.'s Canadian Achievement Test Results in Mathematics

<u>Area</u>	<u>Grade Equivalent</u>	<u>Stanine</u>	<u>Percentile</u>
Math Computation	2.3	1	1
Concepts & Application	0.6	1	1
Total Math	1.5	1	1

An item analysis of J.L.'s CAT scores indicate the following:

- | | |
|------------------------|---|
| Addition | <ul style="list-style-type: none"> - good overall addition skills (8/10 correct) - difficulty adding two-digit and two one-digit numbers, horizontally - difficulty adding two two-digit numbers |
| Subtraction | <ul style="list-style-type: none"> - difficulty in all areas (1/10 correct) - needs work in basic facts, one- and two-digit numbers |
| Multiplication | <ul style="list-style-type: none"> - difficulty in all areas (3/6 correct) but knows some basic facts - needs work in basic facts, two one-digit numbers - requires help multiplying two-digit and one-digit numbers, horizontal, no regrouping |
| Division | <ul style="list-style-type: none"> - no subtest - not part of the Grade 2 curriculum |
| Concepts & Application | <ul style="list-style-type: none"> - difficulty in all areas (9/40 correct) - has virtually no understanding of numeration, number theory, and number properties (2/22 correct) - some knowledge of common scales and measurement/graphs (5/13 correct) - beginning understanding of geometry i.e., triangle, 4-sided figures (2/5 correct) |

The CAT results indicate that J.L. is having a great deal of difficulty in mathematics. Her computation skills are at an early grade 2 level; she is competent in addition, but has virtually no subtraction or multiplication skills. Therefore, her remedial program would focus on building her subtraction and multiplication skills. Her understanding of mathematics concepts is extremely weak (grade equivalent 0.6); she will require extensive remediation in this area. There may be some question as to whether or not J.L. is capable of fully understanding these concepts as she is in grade 5 and is at a mid-grade 1 level in number theory. It would, therefore, be important to look at individual assessment results to realistically establish achievable academic goals for this student.

The DEGEM arithmetic printout, dated May 1988, sorted by urgency, places J.L. at the top of the list. This indicates that she is the student most urgently requiring teacher assistance. The printout indicated that she had completed her fourteenth session (it should be noted that the first twelve sessions are designated for testing). At the present time she is working at an overall grade equivalent level of 1.4. During her last session, J.L. answered forty-seven of sixty-three questions correctly. One of her sixteen errors was a time out error, indicating she did not respond within the allotted time. Only two topics are open to her and the remaining thirteen are closed as she is functioning at a grade level too low to access these topics. She has been dropped a level in Topic 1 (14¹) and is currently working on numerical systems, specifically, filling in the missing number (e.g., 3,4,5,?,7). In Topic 2, addition and subtraction to twenty, she is presently working on addition, adding one to numbers from zero to four.

A diagnostic summary based on the DEGEM data reads as follows: J.L. is a grade 5 student currently placed in special education. She is experiencing a great deal of difficulty in mathematics. She has just begun using the DEGEM system and is functioning at a Grade 1.4 level. There are only two topics open to her; numerical systems, and addition and subtraction to twenty, and she is already experiencing difficulty. She has already been dropped a level in one topic. J.L. is currently working on very basic number concepts and on basic addition facts. In view of the elementary level she is working at, one could question the applicability of the DEGEM system for her. In addition, the diagnostic information provided by DEGEM for J.L. is very limited. For a more comprehensive picture, individual

assessment information would be required and would likely yield more suitable and thorough data.

When the diagnostic summaries from the CAT and DEGEM are compared, both systems indicate that J.L. is having extreme difficulty in mathematics and is functioning at a mid grade 1 level (1.5 CAT; 1.4 DEGEM). Both systems identify her computation skills as very weak and her understanding of numerical concepts as minimal at best. However, the CAT offers a more detailed profile of J.L.'s areas of competencies and weaknesses, giving information on a wider variety of topics. The CAT provides information on all areas of mathematics computation, and concepts and application, whereas the DEGEM system provides information only on the two topics open to her. Therefore, the CAT diagnostic system provides a more complete picture of J.L.'s mathematics skills and skill deficits. It is, however, important to note that neither diagnostic profile provides enough information to develop a comprehensive remediation program. It is advisable that information given by either the CAT or DEGEM be supplemented with other data sources (i.e., individual assessment results).

DISCUSSION: QUESTION NINE

To answer this question adequately is most difficult. In addition to the major difficulty of having the special education classes restructured, two other factors affected the ability to answer this question: one, there was little consistent data, longitudinal or otherwise on the special education students who fell within the parameters of this study; and two, the special education students who were included in this project had only begun to use the DEGEM CAI system (a maximum of 16 sessions). Therefore, a case study format was applied, using only one student. The conclusion for this particular individual was that neither the DEGEM nor the CAT analysis should be used in isolation to develop an individual educational program. The CAT appeared to have one advantage in that it provided information on a broader range of skills.

A number of issues surrounding this question were raised, which merit discussion at the present time. First, *Is DEGEM CAI an appropriate remedial tool for severely*

learning disabled or mentally handicapped students?. This speaks not just to the ability of the system to hold a special needs student's interest, but to the applicability and/or utility of the diagnostic results. This leads to the second question, *Does the information provided on the DEGEM printout significantly contribute to developing an educational profile of a special needs student?*. It appears that these students have such specialized needs that individual assessments are required; therefore, the diagnostic utility of the DEGEM system is extremely limited. Consequently, all that would be left would be the drill activities. This leads to the last question, *Is the content presented in the topics on DEGEM appropriate for special needs students?*. It appears that the answer is likely "yes and no". A teacher would have to be extremely selective of the topics students would be allowed to use, closing some topics to them. Another problem might be that the resulting grade equivalent scores may be too low to allow students access to topics the teacher wants them to use.

Additional data are required to answer this question adequately. It was unfortunate that there were no additional data which could be collected during the second year of the study due to the reorganization of the special education program at Onchaminahos. It appears reasonable to conclude however that the use of DEGEM for special needs students must comprise only one component of the diagnostic and programming strategies for these students.

CHAPTER THREE - SUMMARY AND RECOMMENDATIONS

SUMMARY

During the course of this study, from mid-way through the 1987 -1988 school year to the end of the 1988-1989 school year, the use of the DEGEM computer system at Kehewin and Onchaminahos schools has been fraught with numerous problems and events. Some of these difficulties were internal to the original research design; as well, there were a number of events (e.g., high staff turn over and student cohort contamination) throughout this time frame which had a serious and negative impact on the results. These threats to validity were uncontrollable and definitely impacted the viability of this study and subsequently, the validity of the results. From the perspective of qualitative data collection, information exists which provides a foundation for some interesting discussion and conclusions. However, when the quantitative data are considered in light of the qualitative data, it is possible to suggest some trends and to pose some interesting hypotheses. This, in the end, is the value of this study, which is, to date, the only longitudinal study regarding the educational impact of the use of the DEGEM computer system.

With respect to question one, which is concerned with the instructional benefit of using a combination of DEGEM and classroom instruction over classroom instruction alone, the data are inconclusive. As the data collected to answer this question were to be primarily quantitative, and were greatly contaminated, no valid conclusions could be drawn. However, if in answering this question the qualitative data are also considered, some statements can be tendered. Generally, use of the DEGEM computer system in the mathematics area was perceived as educationally beneficial by both students and teachers. This perception remained positive over time at both school sites. In the language arts area, the DEGEM system was not perceived to be as educationally advantageous as in the mathematics area. This perception remained constant over time. This difference may be due, at least in part, to the apparently poor curriculum fit between the DEGEM English program

software, which emphasizes skills, and the Alberta Language Arts Curriculum, which emphasizes process.

Question two, which was concerned with the appropriateness of the DEGEM CAI courseware and its match with various Alberta Education criteria was investigated by Alberta Education, and the results are reported in Appendix C.

Question three dealt with the diagnostic capability of the DEGEM system, which according to the DEGEM literature, claims to be an effective diagnostic system. The diagnostic profiles obtained from the DEGEM computer were compared to the diagnostic profiles obtained from the Canadian Achievement Tests on a case study basis. This analysis, in combination with results of the teacher interviews and questionnaires, indicated that it is difficult for teachers to fully utilize the diagnostic printout of the DEGEM system. In addition, there was a general consensus that it is not possible to determine the actual value of the DEGEM grade equivalents relative to Alberta standards. Further, the diagnostic capability of the DEGEM system is limited to dealing only with topics which are open to the student determined by the student's overall grade equivalent score. As well, the system is only able to identify weaknesses, and not strengths. Finally, the diagnostic printouts were found to be extremely difficult to interpret. In part this is due to the fact that the user would have to refer to a number of manuals to master the very confusing coding system.

Question four dealt with the issue of the quality and effectiveness of the teacher inservice regarding DEGEM. Through the collection of qualitative data via teacher questionnaire, it was clearly evident that the teachers in both schools responded positively toward the inservice provided, by both the DEGEM personnel and their systems managers. However, it was also evident that the teachers perceived a need for further inservice in order to fully utilize the system. Although every teacher could use the system (i.e., turn it on and off), few teachers had a thorough understanding of the system's potential and no teachers were able to utilize the diagnostic functions of DEGEM.

With respect to question five, which dealt with the impact of DEGEM CAI on students' thinking skills, the quantitative data collected, using the Test of Cognitive Skills, were subject to the same contamination effects discussed previously in

question one. Therefore, it is not possible to draw any conclusions on the basis of these data. However, the qualitative data collected regarding this issue suggests that overall, teachers agreed that the stronger and average students derived the most benefit in this area from working on the DEGEM computer system. It appeared that the weaker students benefitted the least. Further, teacher perceptions indicated that time on the DEGEM system may enhance the student's ability to sequence information. Although teachers indicated that they had noticed an improvement in their students' thinking skills during the course of the school year, they were uncertain that these differences could be attributed to DEGEM.

Data collected in order to answer question six, teacher perceptions of the usefulness of DEGEM and the ability to implement the system as intended, was exclusively qualitative. Both questionnaires and face-to-face interviews were conducted at both sites. Generally, the teachers indicated that they liked the DEGEM system, that it was able to diagnose students' areas of need, that it provided them with information for individualized instruction, and that they wanted to continue to use it. However, most teachers indicated that they did not use the information from DEGEM in any specific way, (e.g., individualizing instruction). Over time, the popularity of the system seemed to wane at Onchaminahos; unfortunately, there was no concurrent data available for Kehewin with respect to this issue. Teachers consistently expressed a desire for further inservice, which was not provided. Teachers did not perceive that the use of the DEGEM computer system had significantly impacted their teaching style, or the nature or quality of student-teacher relationships. Although they generally perceived the courseware to be developmentally appropriate, there was some concern expressed regarding cultural appropriateness. A notable trend emerged which suggested that there is an inverse relationship between teacher knowledge of computers and positive orientation toward DEGEM. That is, the more teachers knew about computers, the less favorably they perceived DEGEM.

Question seven dealt with the students' perceptions of the DEGEM system. As with question six, qualitative data was collected at both sites, using a questionnaire and face-to-face interviews. Generally, the students were positively disposed toward DEGEM, with the Kehewin students being more positively oriented toward the system than Onchaminahos students. However, the Onchaminahos students' response became more positive over time. Students agreed that the system was

easy to use and that they were able to understand the system requirements almost immediately. Generally, division one students were less critical of the system than the division two students. A number of students indicated an interest in using DEGEM in other subject areas. Some dissatisfaction regarding the reliability of the system hardware was evident at both sites. Comments suggesting using color, graphics, and enhancing game formats were noted. Classroom observations were conducted in 1988 to determine whether student time on task differed in the classroom when compared to time on task when on the DEGEM system. The time on task data indicated that there was no difference with respect to time on task whether the students were on the system or in the classroom.

Adequate data collection in response to question eight, regarding the suitability, reliability, flexibility, and cost-efficiency of the DEGEM system, was difficult to obtain. However, on the basis of the data collected, some statements can be made. Teachers generally perceived the system to be unreliable, with Onchaminahos teachers being less positive over time. Students indicated that the system may be unreliable (i.e., the keypads), with the Onchaminahos students becoming more critical over time. Students also increasingly expressed a desire for the utilization of current technology with this system (i.e., using color and graphics). Systems managers indicated that the authoring component is not being used at all and that the system is not particularly flexible. Costs for the system have remained relatively stable over time. Due to lack of information at the school level, cost per student instructional hour could not be calculated.

Question nine dealt with the application of the DEGEM system to the special education context. Data were difficult to obtain in this area, as there was no consistent information available on any special education class. As a result, a case study approach, using only one student, was employed. The conclusion for this particular individual was that the the DEGEM diagnostic information did not provide a comprehensive enough picture to form the basis of an individual program plan. Therefore, if utilized, this information should be used within the context of other data. However, this analysis brought some important issues to light. First, a question as to the suitability of the DEGEM system as an appropriate remedial tool for severely learning disabled or mentally handicapped students. Second, information provided on the DEGEM printout may not significantly contribute to developing an educational profile of a special needs student. The third issue had to

do with the suitability of the topics on DEGEM with respect to special needs students. Additional data will be required to answer this question adequately.

In conclusion, use of the DEGEM computer system at Kehewin and Onchaminahos schools appears to have been positively received by teachers, administrators, parents, and students. However, teachers have indicated that they require extensive inservice in order to fully utilize the DEGEM system. It appears that the diagnostic application of the system is not being fully utilized and that further inservice and support is specifically required in this area. As well, clarification regarding the true meaning of the grade equivalents and an understanding of the coding system used on the DEGEM printout are required. Further, it seems evident that the DEGEM hardware may benefit from some changes which would make it more consistent with other computer systems in terms of reliability and flexibility. This would make it more viable for the educational environment. It appears that there is a need for the technology to be updated and expanded in order to provide more graphics, games, and color features, which appeal to students. Further study regarding the utility and practicality of the DEGEM diagnostic components and the curriculum match of the DEGEM software to Alberta curriculum is warranted.

RECOMMENDATIONS

Given the significant difficulties encountered during the process of attempting to collect the data no recommendation can be made as to whether the DEGEM system should or should not be considered for utilization by schools in Alberta. However, some recommendations can be made which will assist any school considering the use of this system. In addition, the recommendations could be used to guide further quantitative study, should it be undertaken.

It is recommended that:

1. Careful consideration be given to filling the position of systems manager. It appears that, to a very large degree, the successful implementation of this system in a school depends on the skills, background, commitment, and inservice training of the systems manager.

2. Inservice of professional staff is crucial to the full utilization of the system in the school. The system is deceptively simple, in that, very little training is required to operate the system; however, a significant amount of inservice is required to fully utilize the system's diagnostic capabilities.
3. The area of diagnostic effectiveness be further explored prior to making any recommendations to purchase the system. This study, due to initial design flaws and contaminated quantitative data is silent in this area.
4. Prior to deciding to acquire a system, interested parties should contact Alberta Education to obtain information on how the courseware fits with Alberta's curriculum.

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APPENDIX A

QUESTIONNAIRES

Appendix A contains copies of the questionnaires as distributed in 1988 at Onchaminahos School. The only difference between the questionnaires contained herein and those distributed at Kehewin school was that the word "TOAM" was substituted for the word "DEGEM" throughout. The student questionnaire was further modified at both schools for the division one students. In place of the six point rating scale (i.e., 0 to 5) there were a series of happy faces, frowny faces. The "Do Not Know" response was replaced with a question mark.

The student questionnaire distributed in 1989 was identical to those distributed in 1988. The 1989 teacher questionnaire was modified in that all questions which dealt with inservice were removed (i.e., numbers 31 to 45 inclusive) and the balance of the questionnaire was renumbered. The 1988 form of the administrator and the system manager questionnaire were omitted from the 1989 data collection and these individuals were asked to complete the teacher questionnaire.

The Teacher Survey Interview Form was used for the face-to-face interviews in both 1988 and 1989. The Student Survey Interview Form and the Parent Survey Interview Form were used for the face-to-face interviews in 1988, but were not used in 1989.

THE DEGEM COMPUTER

Student Perspectives

Read aloud with the students.

On the following pages are some sentences about the DEGEM computer in your school. Under each sentence is a rating scale with the numbers 0 to 5. The meaning of each number is as follows:

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

After you have read the sentence, decide which number best describes what you think about the sentence. Fill in the right circle on the answer sheet provided. Try not to use Number 2. At the end, there is a chance for you to write what you think about the computer if you want to. Thank You.

TO THE TEACHER:

You will be given a machine scoreable answer sheet for each of your students. Please complete the background information for each of your students. Thank you.

PART I - Background Information

Find the box on the answer sheet labelled "SEX"; indicate your gender by filling in the appropriate circle.

Find the box labelled "GRADE OR EDUC"; indicate the grade you are in by filling in the appropriate circle.

Find the boxes under "IDENTIFICATION NUMBER":

Box "A" - Using the same rating scale as mentioned above answer the following: "I know a lot about computers." Fill in the appropriate circle.

Find the box labelled "SPECIAL CODES". Put your "DEGEM NUMBER" in this box starting with Box K, one digit in each box.

Box "O" - If you are at Kehewin School, fill in the circle "zero" (0). If you are at Saddle Lake School, fill in the circle "one" (1).

Box "P" - If you are an administrator, fill in the circle "zero" (0). If you are a teacher, fill in the circle "one" (1). If you are a system manager, fill in the circle "two" (2). If you are a student, fill in the circle "three" (3).

PART II - General Questions

1. The DEGEM computer helps me learn.

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

2. The DEGEM computer makes my job at school easier.

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

3. I would like to see the DEGEM computer used in other core subjects like social studies and science.

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

4. I would like to see the DEGEM computer used in complementary subject areas like art and music.

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

5. The DEGEM computer helps me learn faster.

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

6. The DEGEM computer bugs me.

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

7. The DEGEM computer does everything I thought it would.

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

8. The DEGEM computer is great!

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

9. We should have more DEGEM computers in our school.

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

10. The DEGEM computer works the way it is supposed to all the time.

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

11. I think the DEGEM computer wastes time.

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

PART III - Specific Questions

Achievement

12. Math is easier for me since I have been using the DEGEM computer.

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

13. Reading is easier for me since I have been using the DEGEM computer.

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

14. Math is more fun when I use the DEGEM computer.

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

15. Reading is more fun when I get to use the DEGEM computer.

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

Student Views

16. I like to work on the DEGEM computer.

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

17. I find the DEGEM computer easy to use.

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

18. I find learning on the DEGEM computer fun.

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

19. I would like to work on the DEGEM computer more often.

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

20. The DEGEM computer helps me learn math better than my math class alone.

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

21. The DEGEM computer helps me learn language arts better than my language arts class alone.

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

22. The DEGEM computer helps me learn my school work.

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

23. What I learn on the DEGEM computer helps me learn in the classroom.

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

24. I need help from my teacher when I use the DEGEM computer.

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

25. I like learning in the classroom better than in the DEGEM computer room.

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

26. I find the questions on the DEGEM computer too hard.

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

27. The DEGEM computer helps me understand my mistakes.

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

28. The DEGEM computer tells me when I'm wrong.

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

29. The DEGEM computer tells me how I'm doing.

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

30. When I'm supposed to be working on the DEGEM computer I waste time.

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

31. It was hard for me to learn how to use the DEGEM computer.

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

32. I understand why my teacher has me using the DEGEM computer.

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

33. I get along better with my teacher since I have been working on the DEGEM computer.

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

34. I learn better in the classroom since I have been using the DEGEM computer.

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

35. When I get stuck on the DEGEM computer my teacher helps me.

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

36. When I make a mistake on the DEGEM computer, I need my teacher to help me understand where I went wrong.

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

37. Ten minutes is too short a time to be on the DEGEM computer.

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

38. In math, sometimes the answers are entered "left to right" and sometimes they are entered "right to left". This confuses me.

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

39. When I am using the DEGEM computer, I find it doesn't work properly.

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

40. When I get a question right, the DEGEM computer lets me know in an interesting way.

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

41. The DEGEM computer graphics are as good as other computers.

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

42. The fact that the DEGEM computer terminal screens use green only rather than several colors disappoints me.

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

43. The way the DEGEM computer asks questions about school subjects is different than the way the textbooks ask questions.

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

44. The way the DEGEM computer asks questions confuses me.

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

The best thing about the DEGEM computer is _____

The worst thing about the DEGEM computer is _____

COMMENTS:

THE DEGEM SYSTEM

Teacher Perspectives

MacRosch Educational Consulting Services Inc. has been contracted by Alberta Education to evaluate several aspects of the DEGEM CAI computer system in your school. Consequently, we are interested in the teachers' perceptions as to how well the computer system functions. The results of this survey will be compiled and analyzed as part of the evaluation. Please note that none of the information obtained will be released in other than report form, and that no individual who completes the survey will be identified.

On the following pages are a series of statements regarding the various aspects of the DEGEM system in your school. For your convenience, at the top of each page is a rating scale with the numbers from 0 to 5 with their meanings. The meaning of each number is as follows:

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

Response 5, "Do Not Know", should also be selected if the question is not applicable to your situation. After you have read the statement and decided which number most accurately describes what you think about the statement, fill in the appropriate circle on the answer sheet provided. Whenever possible, please avoid the use of the "Neutral" (2) response. Please use an HB pencil when completing this survey. There is no need to identify yourself; however, you may do so if you wish. There are opportunities throughout for you to make any written comments which will assist us in obtaining an accurate perception of the DEGEM system as you see it. Thank You.

PART I - Background Information

Find the box on the answer sheet labelled "SEX"; indicate your gender by filling in the appropriate circle.

Find the box labelled "GRADE OR EDUC"; indicate the grade you teach by filling in the appropriate circle.

Find the boxes under "IDENTIFICATION NUMBER":

Box "A" - Using the same rating scale as mentioned above, answer the following: "I am computer literate." Fill in the appropriate circle.

Box "B" - Indicate your years of teaching experience by filling in the appropriate circle.

Box "C" - Indicate your years of administrative experience by filling in the appropriate circle.

This question is designed to find out which program you are currently using with your students. Continue in the box labelled "IDENTIFICATION NUMBER". If the answer is NO, fill in the "0". If the answer is YES, fill in the "1". Which programs do you use:

Box "E" - Math

Box "F" - English

Box "G" - Technical English

Box "H" - Reading Comprehension

Box "I" - Typing

Box "J" - Programming

Find the boxes under "SPECIAL CODES":

Box "O" - If you are at Kehewin School, fill in the circle "zero" (0). If you are at Saddle Lake School, fill in the circle "one" (1).

Box "P" - If you are an administrator, fill in the circle "zero" (0). If you are a teacher, fill in the the circle "one" (1). If you are a systems manager, fill in the circle "two" (2). If you are a student, fill in the circle "three" (3).

PART II - General Questions

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

1. The DEGEM system is an educational asset.
2. The DEGEM system makes my job at school easier.
3. I would like to see the DEGEM system used in other core subjects like social studies and science.
4. I would like to see the DEGEM system used in complementary subject areas like art and music.
5. The DEGEM system speeds up the learning process.
6. The DEGEM system frustrates me.
7. The DEGEM system does everything I thought it would.
8. The DEGEM system is great!
9. We should have more DEGEM computers in our school.

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

10. The DEGEM computer works the way it is supposed to all the time.
11. I think the DEGEM system wastes time.

PART III - Specific Questions

Student Achievement

12. The DEGEM system has contributed to my students' overall basic arithmetic skills.
13. The DEGEM system has contributed to my students' overall problem- solving skills.

The DEGEM system has contributed to my students' overall:

14. Reading comprehension skills.
15. Vocabulary skills.
16. Decoding skills.
17. Reading fluency.
18. Grammar skills.
19. Punctuation skills.
20. Spelling skills.

0
Strongly
Disagree

1
Disagree

2
Neutral

3
Agree

4
Strongly
Agree

5
Do Not
Know

The way that the DEGEM System has contributed the most to the achievement of my students is that it _____

One way to improve on what the system does would be to _____

COMMENTS _____

Diagnostics

21. I think that the DEGEM system is able to adequately diagnose the problems my students have.
22. The DEGEM diagnosis is adequate for my weaker students.
23. The DEGEM diagnosis is not adequate for my average students.
24. The DEGEM diagnosis is adequate for my stronger students.
25. The DEGEM diagnosis supports (is consistent with) other information I have on my students.

0
Strongly
Disagree

1
Disagree

2
Neutral

3
Agree

4
Strongly
Agree

5
Do Not
Know

26. The DEGEM diagnosis is not consistent with my impressions of my students.
27. The DEGEM diagnosis helps me in attending to the educational needs of my students.
28. I understand how to use the DEGEM printout to diagnose my students' needs.
29. Information that DEGEM gives me on my students is not compatible with the information I get from the CTBS.
30. The DEGEM system ranks students in the same order I do.

The greatest strength in the DEGEM's diagnostic ability is that _____

The area in diagnosis that causes me the most difficulty is _____

COMMENTS _____

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

Inservice

The questions in this section are divided into two parts. The questions in Part A refer to the initial training you received from the DEGEM staff. Part B questions refer to any additional training you may have received from "in-house" personnel.

Part A - DEGEM Staff

31. I was satisfied with the level of training I received regarding the DEGEM computer system.
32. I found my comfort level with the DEGEM system was enhanced by the training I received.
33. I saw new ways to deliver the curriculum to my students using the DEGEM system.
34. The DEGEM system has worked as well they told me it would.
35. As a result of the training, I have an adequate knowledge of the operation of the DEGEM HARDWARE.
36. As a result of the training, I have an adequate knowledge of the operation of the DEGEM SOFTWARE.
37. The training has provided me with adequate knowledge of the operation of the DEGEM record keeping functions.
38. As a result of the training, I have an adequate knowledge of the operation of the DEGEM authoring system.

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

39. As a result of the training, I have an adequate knowledge of the operation of the DEGEM student diagnostic system.
40. As a result of the training, I have an adequate knowledge of how to register my class on the DEGEM system.
41. Since I was training on the DEGEM system I have found new uses for the system that were not covered in the training.
42. There were major content areas not covered in the training.
43. I suffered from information overload during the training.
44. I found the pacing of the training to be inappropriate.
45. I was satisfied with the expertise of the individuals who did the training.

Part B - Local Staff

46. I would not find periodic upgrading useful.
47. I found my comfort level with the DEGEM system was enhanced by the training I received.
48. As a result of the training, I have an adequate knowledge of the operation of the DEGEM HARDWARE.
49. As a result of the training, I have an adequate knowledge of the operation of the DEGEM SOFTWARE.
50. The training has provided me with adequate knowledge of the operation of the DEGEM record keeping functions.

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

51. As a result of the training, I have an adequate knowledge of the operation of the DEGEM authoring system.
52. As a result of the training, I have an adequate knowledge of the operation of the DEGEM student diagnostic system.
53. As a result of the training, I have an adequate knowledge of how to register my class on the DEGEM system.
54. I suffered from information overload during the training.
55. I found the pacing of the training to be inappropriate.
56. I was satisfied with the expertise of the individuals who did the training.
57. I understand the intended use of the DEGEM system in my school.

One thing I would like to have seen done to improve the training would have been to _____

One thing that could have been left out of the training was _____

COMMENTS _____

0
Strongly
Disagree

1
Disagree

2
Neutral

3
Agree

4
Strongly
Agree

5
Do Not
Know

Thinking Skills

58. Since my students have been on the DEGEM system, I have noticed an improvement in their thinking skills.
59. Since my students have been on the DEGEM system, I have not noticed any changes in the way they approach problems they encounter.
60. Since my students have been on the DEGEM system, I have noticed that my stronger students approach problems they encounter in a superior way.
61. Since my students have been on the DEGEM system, I have noticed that my average students approach problems they encounter in a superior way.
62. Since my students have been on the DEGEM system, I have noticed that my weaker students approach problems they encounter in a superior way.
63. My students are better able to sequence since using the DEGEM system.
64. My students who are better able to sequence benefit more from the DEGEM program.

COMMENTS _____

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

Teacher Application

65. The DEGEM system allows me to provide individualized instruction for my students.
66. I individualize instruction for more of my students since using the DEGEM system.
67. In my classroom, students receive less individualized instruction now than they did prior to the arrival of the DEGEM system.
68. I individualize instruction for each of my students in the regular classroom based upon the DEGEM system results.
69. The DEGEM system does not assist me in diagnosing my students' strengths.
70. The DEGEM system does not assist me in diagnosing my students' weaknesses.
71. The DEGEM system provides me with information that allows me to remediate my students' deficits.
72. The DEGEM system is able to remediate my students' deficits.
73. I am capable of assigning my student's entry level tasks on the DEGEM system.
74. When I assign the student entry level it is appropriate.
75. When the DEGEM system assigns the student entry level it is appropriate.

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

76. I prefer to assign the student entry level myself rather than let the computer do it.
77. Since the DEGEM system has arrived I have changed the way I teach in my classroom.
78. The DEGEM system is not compatible with my teaching style.
79. I am using my students' DEGEM experience to enhance learning in the classroom.
80. Since using the DEGEM system, I have more flexibility in how I can teach.
81. Since my students have been on the DEGEM system, I find I have less reteaching to do.
82. I use the DEGEM system information to determine which concepts require reteaching in the classroom.
83. Since the DEGEM system has arrived, I am better able to know when to reteach a concept.
84. Since the DEGEM system has arrived, I am better able to know how to reteach a concept.
85. Since the DEGEM system has arrived, I am better able to know what material to reteach.
86. The DEGEM system assists me in evaluating student progress.
87. The information the DEGEM system provides assists me when I am assigning student grades.

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

88. The DEGEM diagnostic student results should be used to assist in determining student retention/promotion.
89. The DEGEM system assists me in recording student progress.
90. Report card marks should not reflect DEGEM system results.
91. I change the DEGEM system parameters to change the aspects of the drill.
92. The DEGEM courseware is inappropriate for the curriculum at the grade level I am teaching.
93. The DEGEM courseware is appropriate for the developmental level of the students in the grade level I am teaching.
94. The DEGEM courseware is appropriate to the cultural needs of the students at the grade level I am teaching.
95. The DEGEM system will enhance learning for all students in the school.
96. Since using the DEGEM system, I find that my relationship with my stronger students has changed for the better.
97. Since using the DEGEM system, I find that my relationship with my weaker students has changed for the better.
98. Since using the DEGEM system, I find that my relationship with my average students has changed for the better.
99. Since the DEGEM system has been in place, I interact more with each of my students.

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

100. Since the DEGEM system has been in place, I interact less with each of my students.
101. I present the topic in the classroom before I start my students on the DEGEM system.
102. Since using the DEGEM system, I find that I do not have to do as much classroom teaching on how to apply the concept.
103. In arithmetic, the fact that some of the answers are entered "left to right" and some are entered "right to left" confuses my students.
104. The students in my classroom frequently exceed the limits of the DEGEM system, that is, go off the high end of the scale.
105. My weaker students are academically too weak to benefit from their time on the DEGEM computer.
106. My average students are academically too weak to benefit from their time on the DEGEM computer.
107. My stronger students are academically too weak to benefit from their time on the DEGEM computer.
108. _____ percent of my students have trouble paying attention (are off task) during the 10-minute session.
109. I use the DEGEM system grade equivalent scores in determining how my students are achieving.
110. I use the change in grade equivalent scores reported by the DEGEM system to determine student achievement.

0
Strongly
Disagree

1
Disagree

2
Neutral

3
Agree

4
Strongly
Agree

5
Do Not
Know

111. The way the DEGEM system asks questions regarding subject matter is different than the way the textbooks ask questions.

112. The way the DEGEM system asks questions confuses many of my students.

If I could change one thing about how the system is being used in this school, I would _____

The thing that I do not think should be changed is _____

The most useful information that I get from the DEGEM system is _____

The one piece of information that the DEGEM system gives me that I could do without is _____

COMMENTS _____

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

Hardware/Software

113. There are topics in language arts I wish the DEGEM system dealt with.
114. There are topics in mathematics I wish the DEGEM system dealt with.
115. Additional topics should be included in the DEGEM system at some point.
116. My students move more quickly through the topics than I expected.
117. When I am using the DEGEM computer, I find it does not work properly.
118. When I take my class to work on the DEGEM computer, I find the whole system (mainframe computer) is not working.
119. When I take my class to work on the DEGEM computer, I find the detachable keyboard is not working.
120. When I take my class to work on the DEGEM computer, I find the student terminal (including the keys) is not working.
121. The DEGEM software appears to be outdated.
122. Being unable to run the language arts program and the math program at the same time is a disadvantage.
123. The DEGEM computer provides adequate reinforcement for my students.
124. The DEGEM system graphics are as good as other computers.
125. The fact that the terminal screens use green only, rather than several colors, does not affect my students' motivation.

COMMENTS _____

If I were to sum up the impact that DEGEM has had in the school, I would say ____

THE DEGEM SYSTEM

Administrator Perspectives

On the following pages are a series of statements regarding the various aspects of the DEGEM system in your school. For your convenience, at the top of each page is a rating scale with the numbers from 0 to 5 with their meanings. The meaning of each number is as follows:

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

Response 5, "Do Not Know", should also be selected if the question is not applicable to your situation. After you have read the statement, decide which number most accurately describes what you think about the statement, and then fill in the appropriate circle on the answer sheet provided. Whenever possible, please avoid the use of the "Neutral" (2) response. Please use an HB pencil when completing this survey. There are opportunities throughout for you to make any written comments which will assist us in obtaining an accurate perception of the DEGEM system as you see it. Thank You.

PART I - Background Information

Find the box on the answer sheet labelled "SEX"; indicate your gender by filling in the appropriate circle.

Find the box labelled "GRADE OR EDUC"; indicate the grade you teach by filling in the appropriate circle.

Find the boxes under "IDENTIFICATION NUMBER":

Box "A" - Using the same rating scale as mentioned above, answer the following: "I am computer literate." Fill in the appropriate circle.

Box "B" - Indicate your years of teaching experience by filling in the appropriate circle.

Box "C" - Indicate your years of administrative experience by filling in the appropriate circle.

Box "D" - Indicate your years of administrative experience in this school by filling in the appropriate circle.

Find the boxes under "SPECIAL CODES":

Box "O" - If you are at Kehewin School, fill in the circle "zero" (0). If you are at Saddle Lake School, fill in the circle "one" (1).

Box "P" - If you are an administrator, fill in the circle "zero" (0). If you are a teacher, fill in the circle "two" (2). If you are a student, fill in the circle "three" (3).

PART II - General Questions

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

1. The DEGEM system is an educational asset.
2. The DEGEM system makes my administrative job at school easier.
3. I would like to see the DEGEM system used in other core subjects like social studies and science.
4. I would like to see the DEGEM system used in complementary subject areas like art and music.

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

5. The DEGEM system speeds up the learning process.
6. The DEGEM system frustrates me.
7. The DEGEM system does everything I thought it would.
8. The DEGEM system is great!
9. We should have more DEGEM computers in our school.
10. The DEGEM computer works the way it is supposed to all the time.
11. I think the DEGEM system wastes time.

PART III - Specific Questions

Student Achievement

12. Since the students have been using the DEGEM system, I have noticed an overall improvement in basic arithmetic skills.
13. Since the students have been using the DEGEM system, I have noticed an overall improvement in language arts skills.

The greatest change in student achievement that I have noticed since the arrival of the DEGEM system is _____

0
Strongly
Disagree

1
Disagree

2
Neutral

3
Agree

4
Strongly
Agree

5
Do Not
Know

One thing about student achievement that has not changed is _____

COMMENTS:

Diagnosis

14. The DEGEM diagnosis supports (is consistent with) other information I have on the students.
15. The DEGEM diagnosis helps teachers in attending to the educational needs of their students.
16. Information that DEGEM gives me on the students is not compatible with the information I get from the CTBS.

The most favorable thing the DEGEM provides regarding diagnosis of student achievement is _____

0
Strongly
Disagree

1
Disagree

2
Neutral

3
Agree

4
Strongly
Agree

5
Do Not
Know

The greatest weakness regarding diagnosing student achievement is _____

Inservice

The questions in this section are divided into two parts. The questions in Part A refer to the initial training you received from the DEGEM staff. Part B questions refer to any additional training you may have received from "in-house" personnel.

Part A - DEGEM staff

17. Teachers are satisfied with the level of training they received regarding the DEGEM computer system.
18. The DEGEM system has worked as well as they told me it would.
19. The training has provided me with an adequate knowledge of the operation of the DEGEM record keeping functions.

One thing I would retain in the inservice is _____

One thing I would do differently to inservice the teachers is _____

0
Strongly
Disagree

1
Disagree

2
Neutral

3
Agree

4
Strongly
Agree

5
Do Not
Know

COMMENTS

Part B - Local Staff

20. Teachers are satisfied with the level of training they received regarding the DEGEM computer system.
21. I understand the intended use of the DEGEM system in my school.

Administrator Perceptions

22. The DEGEM system student results should not be used to assist in determining student retention/promotion.
23. The DEGEM system assists me in monitoring student progress.
24. Report card marks should reflect DEGEM system results.
25. The DEGEM system courseware is inappropriate for the curriculum.
26. The DEGEM system courseware is appropriate to the cultural needs of the students.
27. The DEGEM system will enhance learning for all students in the school.

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

28. The DEGEM system has created significant timetabling difficulties.
29. The DEGEM system has enhanced teacher record keeping.
30. The DEGEM system has enhanced teachers' individualized instruction planning.
31. The DEGEM system has caused an increase in teacher requests for supplementary resource materials.
32. Teachers perceive that their DEGEM computer time allotment is adequate.
33. As teachers' classrooms are visited, a general change in teaching styles is noticeable.
34. The DEGEM system printouts enable me to monitor how my teachers are meeting their students' educational needs.

The biggest difference that the arrival of the DEGEM system has made to the teachers is _____

The biggest difference that the arrival of the DEGEM system has made to the students is _____

0
Strongly
Disagree

1
Disagree

2
Neutral

3
Agree

4
Strongly
Agree

5
Do Not
Know

One thing that I thought would change but did not is _____

COMMENTS

Hardware/Software

35. The DEGEM system crashes (does not function) frequently.

36. The DEGEM hardware often requires maintenance.

COMMENTS

If I were to sum up the impact that DEGEM has had in the school I would say

THE DEGEM SYSTEM

System Manager Perspectives

On the following pages are a series of statements regarding the various aspects of the DEGEM system in your school. Under each statement is a rating scale with the numbers from 1 to 5. The meaning of each number is as follows:

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

Response 5 "Do Not Know" should also be selected if the question is not applicable to your situation. After you have read the statement and decided which number most accurately describes what you think about the statement, fill in the appropriate circle on the answer sheet provided. Whenever possible, please avoid the use of the "Neutral" (2) response. Please use an HB pencil when completing this survey. There are opportunities throughout for you to make any written comments which will assist us in obtaining an accurate perception of the DEGEM system as you see it. Thank You.

PART I - Background Information

Find the box on the answer sheet labelled "SEX"; indicate your gender by filling in the appropriate circle.

Find the box labelled "GRADE OR EDUC"; indicate the grade you teach by filling in the appropriate circle.

Find the boxes under "IDENTIFICATION NUMBER":

Box "A" - Using the same rating scale as mentioned above, answer the following: "I am computer literate." Fill in the appropriate circle.

Box "B" - Indicate your years of teaching experience by filling in the appropriate circle.

Box "C" - Indicate your years of administrative experience by filling in the appropriate circle.

Find the boxes under "SPECIAL CODES":

Box "O" - If you are at Kehewin School, fill in the circle "zero" (0). If you are at Saddle Lake School, fill in the circle "one" (1).

Box "P" - If you are an administrator, fill in the circle "zero" (0). If you are a teacher, fill in the the circle "one" (1). If you are a systems manager, fill in the circle "two" (2). If you are a student, fill in the circle "three" (3).

PART II - General Questions

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

1. The DEGEM system is an educational asset.
2. The DEGEM system makes my job at school easier.
3. I would like to see the DEGEM system used in other core subjects like social studies and science.
4. I would like to see the DEGEM system used in complementary subject areas like art and music.
5. The DEGEM system speeds up the learning process.
6. The DEGEM system frustrates me.

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

7. The DEGEM system does everything I thought it would.
8. The DEGEM system is great!
9. We should have more DEGEM computers in our school.
10. The DEGEM computer works the way it is supposed to all the time.
11. I think the DEGEM system wastes time.

PART III - Specific Questions

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

Inservice

The inservice referred to here is the training provided by the DEGEM staff to you and the staff in the school.

12. I was aware of how the DEGEM system was to be implemented in the school.
13. I had all the information I required before the DEGEM computer system arrived in the school.
14. I now have all the information I require to operate the DEGEM system.
15. I received an adequate training experience from the DEGEM staff.
16. My level of training differed significantly from that of the teachers.

0
Strongly
Disagree

1
Disagree

2
Neutral

3
Agree

4
Strongly
Agree

5
Do Not
Know

The greatest strength of the inservice I received was _____

The greatest weakness of the inservice was _____

One thing that should be included in all future teacher inservices is _____

One area that could be de-emphasized in future inservices is _____

COMMENTS _____

Systems Operator Perspectives

17. The DEGEM system has caused an increase in teacher requests for supplementary resource materials.
18. Teachers perceive that their computer time allotment is adequate.

0	1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Do Not Know

COMMENTS _____

Hardware/Software

19. The program allows for the addition of new topics.
20. It is easy to add new topics to the program.
21. The DEGEM system crashes frequently.
22. The DEGEM system mainframe crashes frequently.
23. The DEGEM system student terminals malfunction frequently.
24. The DEGEM system student terminal keyboards malfunction frequently.
25. I frequently find errors in the DEGEM system software.
26. The DEGEM hardware often requires maintenance.
27. I am able to handle most of the problems that the system has.
28. I spend a lot of my time fixing system problems (hardware/software).
29. Vendor support for software is adequate.
30. Vendor support for hardware is adequate.

0
Strongly
Disagree

1
Disagree

2
Neutral

3
Agree

4
Strongly
Agree

5
Do Not
Know

31. Vendor support in terms of trouble shooting is adequate.
32. The DEGEM software appears to be outdated.
33. The supporting documentation for DEGEM is adequate for my needs.
34. I often use the authoring features of this program.
35. Being unable to run the language arts program and the math program at the same time is a disadvantage.

One thing I would suggest to improve the quality of the software is _____

One thing that is very good about the software is _____

The biggest concern I have regarding hardware is _____

The best thing about the hardware is _____

COMMENTS _____

If I were to sum up the impact that DEGEM has had in the school I would say ____

TEACHER SURVEY

INTERVIEW FORM

DEGEM CAI

Demographic Data:

Grade Taught _____ Gender _____ Years of teaching experience _____

Subject(s) for which you are using the DEGEM computer:

Mathematics _____ Language Arts _____ Other _____

Specify _____

Interview Questions:

1. Has using the DEGEM system impacted your teaching in any way?

Yes _____ No _____ Explain _____

How do you use the DEGEM computer to assist you in your teaching?

Drill _____ Remediation _____ Diagnosis _____ Reward _____ Other _____

Explain _____

Comments _____

2. Complete the following sentences:

The easiest thing about using the DEGEM system is _____

The hardest thing about using the DEGEM system is _____

Overall, using a scale from 1 to 10, with **1 low** and **10 high**, how easy is the system to use?

1 2 3 4 5 6 7 8 9 10

3. Do your students like using the DEGEM computer? Yes _____ No _____

What are the indicators? _____

Are there certain students who seem to like/dislike it more? Yes _____ No _____

Explain _____

4. Using a scale from 1 to 10, with **1 low** and **10 high**, how much have your students benefitted from their experience with DEGEM?

1 2 3 4 5 6 7 8 9 10

Are there certain students who seem to benefit more? Yes _____ No _____

Explain _____

5. Using a scale from 1 to 10, with **1 low** and **10 high**, how familiar are you with computers?

1 2 3 4 5 6 7 8 9 10

Which other systems have you used? Apple _____ Commodore _____

IBM _____ Tandy _____ Other _____, if "Other" identify _____

What was the primary purpose for which you used the other system . _____

Using a scale from 1 to 10, with **1 low** (compares poorly) and **10 high** (compares favorably), how does DEGEM compare?

1 2 3 4 5 6 7 8 9 10

6. Are there any different ways you would like to see DEGEM being used in your school? _____

7. Finish the following sentences:

The best thing about the DEGEM computer is _____

The worst thing about the DEGEM computer is _____

8. How would you rate the impact of the DEGEM computer system on your students' learning, using a scale from 1 to 10, with **1 none** and **10 very significant**?

1 2 3 4 5 6 7 8 9 10

Comments _____

9. Do you have any other comments you would like to make about the DEGEM computer _____

Thank you very much for your cooperation.

STUDENT SURVEY

INTERVIEW FORM

DEGEM CAI

Demographic Data:

Grade _____ Gender _____ Age _____

Subject(s) for which you are using the DEGEM computer:

Mathematics _____ Language Arts _____ Other _____

Specify _____

Interview Questions:

1. Do you like working on the DEGEM computer? Yes _____ No _____
Can you tell me more about that? _____

2. Pick a number that tells how much you like the DEGEM computer - **1 is low**
and **10 is high**.

1 2 3 4 5 6 7 8 9 10

3. How much do you get to use the computer? _____

Is that enough time for you? Yes _____ No _____. Can you tell me more
about that? _____

4. Finish this sentence. The best thing about the DEGEM computer is _____

5. Finish this sentence. The worst thing about the DEGEM computer is _____

6. Do you remember when we came into your classroom and asked you questions about the computer? Was there an important question about the computer we should have asked? Yes _____ No _____.

If "Yes", explain _____

7. If you could make one wish about the computer, what would it be? _____

Thank you very much for helping me today.

PARENT SURVEY

INTERVIEW FORM

DEGEM CAI

Demographic Data (Re: Child(ren)):

Grade(s) of Child(ren) _____

Age(s) of Child(ren) _____

Gender(s) of Child(ren) _____

Interview Questions:

1. Are you aware that your child uses the DEGEM computer at school?
Yes _____ No _____

2. Does your child talk about working on the DEGEM computer?
Yes _____ No _____. If "Yes", a little _____; a lot _____

3. What kinds of things does your child say about the DEGEM computer?
Likes working on it _____ Finds it motivating _____ Does not like it _____
Finds it boring _____ Would like his own computer _____ Would like to
spend more time on it _____ Does not say anything _____ Other _____;
Specify _____

4. Have you noticed any differences in your child's attitude toward school since
he/she began using the computer? Yes _____ No _____. If "Yes", positive
change _____; negative change _____; other _____. Explain as necessary _____

5. Have you noticed any changes in your child's school marks since he/she
began to use the DEGEM computer? Yes _____ No _____. If "Yes",
explain _____

6. How would you rate the impact of the DEGEM computer system on your child(ren), using a scale from 1 to 10 with **1 low** and **10 high**.

1 2 3 4 5 6 7 8 9 10

Comments _____

7. Given what your child has said about the DEGEM computer system, would you like a chance to use it? Yes _____ No _____. If "Yes", what areas interest you: Vocational _____; Upgrading _____; Secretarial _____; Other _____, if "Other" please explain _____

8. Do you have any other comments you would like to make about the DEGEM computer? _____

Thank you very much for your cooperation.

APPENDIX B

DEGEM PRINTOUTS
AND
CAT RESULTS
-CASE STUDIES-

QUESTION THREE - CASE A

SCHOOL = KEHEWIN
 CLASS = 04 Arithmetic 5-17-88

NO.	NAME	C/T	TO/ER	SE	TE	AV	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
3032 M		27/33	0/6	67	38	40	+	38	38	+	37	38	36 [^] 1	36	-	-	-	-	-	36 [^] 08	-
3044 M		12/20	5/8	69	38	38	+	38 [^] 1	38	+	38	38 [^] 1	40	42 [^] 1	-	-	-	-	-	35 [^] 04	-
3057 D		38/44	0/6	69	31	33	+	31 [^] 1	30 [^] 1	33	-	-	-	31	30	-	-	-	-	28 [^] 03	-
3071 M		24/30	1/6	74	41	43 [^] 1	+	42 [^] 1	42	+	43	37	43	42	42	40 [^] 1	-	-	-	39 [^] 09	-
3083 C		20/41	2/21	69	29	28	25 [^] 1	25 [^] 1	27 [^] 1	33 [^] 4	-	-	-	28	28	-	-	-	-	29	-
3095 J		24/30	3/6	70	39	43 [^] 1	+	40	39	+	37 [^] 1	38	40	41	-	-	-	-	-	36 [^] 06	-
3107 M		1/8	6/7	59	30	35	+	28	28	30	-	-	-	29	28	-	-	-	-	30	-
3119 B		29/40	1/11	69	32	34 [^] 2	+	30 [^] 2	33	35	-	-	-	34	31	-	-	-	-	30	-
3121 M		39/45	1/6	38	21	26	15	-	-	-	-	-	-	-	23	-	-	-	-	21	-
3133 V		11/21	2/10	72	43	44	+	45	42	+	40 [^] 2	37 [^] 1	45	43	46	42 [^] 2	-	-	-	45	-
3158 L		10/20	3/10	67	31	34 [^] 2	+	29	29 [^] 2	33	-	-	-	30	36	-	-	-	-	27 [^] 02	-
3881 J		19/32	3/13	5	5	39	39	+	39	39	39	39	39	39	39	-	-	-	-	39	-
3905 J		17/30	1/13	3	3	48	48	+	48	48	+	48	48	48	48	48	-	-	-	48	48
10433 C		17/46	4/29	12	12	13	11	10	-	-	-	-	-	-	-	-	-	-	-	-	-
10445 D		15/33	4/18	4	4	31	31	+	31	31	31	-	-	31	31	-	-	-	-	31	-

AVERAGES:

50	6	34	35	17	36	36	33	40	39	36	45	43	34	48
----	---	----	----	----	----	----	----	----	----	----	----	----	----	----

NUMBER OF STUDENTS: 15

REPORT SORTED ACCORDING TO: STUDENT NUMBER

CANADIAN TEST CENTRE



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TEST	RS	SS	GE	NP	NS	NATIONAL PERCENTILE									
Reading Vocabulary	12	386	3.0	16	3	xxxxxxx									
Reading Comprehension	17	459	2.8	18	3	xxxxxxx									
TOTAL READING	29	425	3.0	17	6	xxxxxxx									
SPELLING	16	529	7.0	41	5	xxxxxxx									
Language Mechanics	14	510	4.3	21	3	xxxxxxx									
Language Expression	20	458	3.0	26	4	xxxxxxx									
TOTAL LANGUAGE	34	480	3.6	25	4	xxxxxxx									
Mathematics Computation	17	386	3.0	16	3	xxxxxxx									
Math Concepts & Applications	31	448	5.2	35	6	xxxxxxx									
TOTAL MATH	48	403	4.2	44	5	xxxxxxx									
TOTAL BATTERY	127	414	3.8	27	4	xxxxxxx									
REFERENCE SKILLS	15	475	4.1	38	4	xxxxxxx									

GE = Grade Equivalent
 *** = No score available

SS = Scale Score
 NP = National Stanine
 NS = National Percentile

PERFORMANCE BY CATEGORY OBJECTIVE									
LANGUAGE EXPRESSION									
34 Pronouns									
35 Verbs									
36 Adjectives									
37 Subjects/Verbs									
38 Modifying/Transitional Words									
39 Complete/Incomplete/Faulty									
42 Sequence/Irrelevant Sentence									
MATHEMATICS COMPUTATION									
45 Addition									
46 Subtraction									
47 Multiplication									
48 Division									
MATH CONCEPTS & APPLICATIONS									
49 Numeration									
50 Number Theory									
51 Number Properties/Sentences									
54 Measurement									
55 Graphs									
56 Geometry									
57 Problem Solving									
58 Rounding/Estimation									
REFERENCE SKILLS									
60 Table of Contents									
61 Index									
62 Map									
65 Dictionary Page									
66 Library Catalogue Cards									

KEY: 1 = low; c = competent; p = proficient; n = no score available

For an explanation of this report, please see reverse side

CANADIAN TEST CENTRE



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Code Explanation

+ = correct answer
- = incorrect answer
* = no response
** = score not available

Number of students in group = 13

Reference group (Ref) is the national sample of Grade 4.7

M M D N C D G G J J K D P T W Y V J L

Average No. Percent
Items Right: Right on
for Objective Item

Class Ref Class Ref

MATHEMATICS COMPUTATION

No. of valid sub-test scores: 13

Objective	45 (10 Items)	5.7	6.3	9	8	6	6	5	3	8	7	1	2	7	6	6
Addition																
01 Three-Dig + Two-Dig, Hor, No Regr				92	89	+	+	+	+	+	+	+	+	+	+	+
02 Three-Dig + 2 Two-Dig, No Regr				69	83	+	+	+	+	+	+	+	+	+	+	+
23 4 Four-Dig				54	54	+	+	+	+	+	+	+	+	+	+	+
04 Column, Up to Three-Dig				38	70	+	+	+	+	+	+	+	+	+	+	+
21 Column, Up to Four-Dig				62	59	+	+	+	+	+	+	+	+	+	+	+
22 Horiz, Up to Four-Dig				54	49	+	+	+	+	+	+	+	+	+	+	+
24 Like Fractions				8	29	+	+	+	+	+	+	+	+	+	+	+
03 Decimal Fractions, Horiz, No Regr				77	86	+	+	+	+	+	+	+	+	+	+	+
25 Decimal Fractions, Horiz, No Regr				54	36	+	+	+	+	+	+	+	+	+	+	+
05 Money, 2 Three-Dig				62	76	+	+	+	+	+	+	+	+	+	+	+
Objective 46 (10 Items)				9	4	4	7	3	4	7	2	1	9	7	2	
Subtraction																
26 Three-Dig - Two-Dig, Hor, No Regr				54	73	+	+	+	+	+	+	+	+	+	+	+
10 Three-Dig - Two-Dig				38	62	+	+	+	+	+	+	+	+	+	+	+
06 2 Three-Dig, No Regr				85	83	+	+	+	+	+	+	+	+	+	+	+
30 Four-Dig - Three-Dig				23	41	+	+	+	+	+	+	+	+	+	+	+
29 2 Five-Dig				23	41	+	+	+	+	+	+	+	+	+	+	+
28 Like Fractions				15	29	+	+	+	+	+	+	+	+	+	+	+
08 Mixed No. - Whole No				85	81	+	+	+	+	+	+	+	+	+	+	+
07 Decimal Fr, 2 Two-Dig, No Regr				85	80	+	+	+	+	+	+	+	+	+	+	+
27 Decimal Fr, 2 Three-Dig				31	55	+	+	+	+	+	+	+	+	+	+	+
09 Money, 2 Three-Dig				38	60	+	+	+	+	+	+	+	+	+	+	+

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	M M D N C D J M B W V J L											
	Average No. Items Right for Objective		Percent Right on Item		Class Ref		Class Ref		Class Ref		Class Ref	
Objective 47 (10 Items)	5.5	5.7										
Multiplication												
11 2 One-Dig			100	87	+	+	+	+	+	+	+	+
12 Mult of 10 x One-Dig, Horiz			54	80	+	+	+	+	+	+	+	+
13 Two-Dig x One-Dig, Horiz			85	74	+	+	+	+	+	+	+	+
31 Two-Dig x One-Dig			46	50	+	+	+	+	+	+	+	+
35 2 Two-Dig			31	23	+	+	+	+	+	+	+	+
33 Two-Dig (1 Mult of 10)			31	31	+	+	+	+	+	+	+	+
14 Three-Dig x One-Dig			38	70	+	+	+	+	+	+	+	+
15 Four-Dig x One-Dig			54	58	+	+	+	+	+	+	+	+
32 Mult of 100 x Mult of 10, Horiz			62	63	+	+	+	+	+	+	+	+
34 Money, Three-Dig x One-Dig			46	37	+	+	+	+	+	+	+	+
Objective 48 (10 Items)	5.2	4.4										
Division												
16 Two-Dig + One-Dig, No Rem			77	82	+	+	+	+	+	+	+	+
17 Two-Dig + One-Dig, No Rem			69	78	+	+	+	+	+	+	+	+
20 Mult of 10 + One-Dig			69	56	+	+	+	+	+	+	+	+
19 Two-Dig + One-Dig			46	42	+	+	+	+	+	+	+	+
18 Three-Dig + One-Dig, No Rem			54	44	+	+	+	+	+	+	+	+
37 Three-Dig + One-Dig, No Rem			38	37	+	+	+	+	+	+	+	+
38 Three-Dig + One-Dig, No Rem			54	27	+	+	+	+	+	+	+	+
36 Three-Dig + One-Dig			54	33	+	+	+	+	+	+	+	+
40 Three-Dig + Mult of 10			23	17	+	+	+	+	+	+	+	+
39 Money, Four-Dig + One-Dig			31	28	+	+	+	+	+	+	+	+

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Code Explanation	M	M	D	N	C	D	J	M	B	W	V	J	L

+ = correct answer													
- = incorrect answer													
= no response													
** = score not available													

Number of students in group = 13
 Reference group (Ref) is
 the national sample of Grade 4.7

Average No. Items Right for Objective	Percent Right on Item	Class	Ref	Class	Ref	2	4	4	5	4	3	2	2	2	2	5	4	2
3.2	3.9	13																
Objective 49 (6 Items)																		
49 Renaming Number	62	80																
45 Place Value, Thousands	85	88																
50 Greatest Value, Four-Dig	38	75																
82 Expanded Notation	31	42																
70 Number Line, Mixed No	31	50																
68 Fraction of Whole, One-Fifth	69	53																
Objective 50 (4 Items)	2.2	2.6																
Number Theory																		
59 Sequence, Subt Fours	62	72																
60 Odd Numbers	69	69																
63 Factors of 8 and 10	54	70																
72 Multiples of 2 and 3	31	47																
Objective 51 (6 Items)	3.4	3.5																
Number Properties/Sentences																		
51 Identity Element, Mult	85	77																
43 Math Symbols, Div	92	90																
78 Math Symbols, Div Equation	38	45																
73 Mult Equation, Solve for Box	31	33																
48 Div Equation, Solve for n	46	69																
83 Equations, True Sentence	46	38																

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QUESTION THREE - CASE B

SCHOOL = SADDLE LAKE
 CLASS = 500 English

NO.	NAME	C/T	TO/ER	TESTING		TE	LOW LEVEL	HIGH LEVEL	LEVELS
				SE	SE				
2511	Willa H	29/36	0/7	1	1	1		0	0

REPORT SORTED ACCORDING TO: URGENCY

NO.	NAME	C/T	TO/ER	SE	AV	PRACTICE														
						1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
2545 R		20/45	0/25	15	37	36	36	-37	36	36	-	-	-37	37	-37	36	36	36	36	-38
2651 T		7/20	3/13	11	27	-	-27	26	-	26	-	-	-26	26	-	-	27	-	-	-
2509 O		24/40	0/16	15	32	-32	32	32	-	32	-	-	-32	33	-32	31	31	-	-	-
2624 G		9/26	0/17	14	34	33	33	34	-	34	-	-	-35	34	-34	33	35	33	-	34
2547 V		9/29	0/20	16	26	-	26	26	-	-26	-	-	-25	26	-	-	-27	-	-	-
2562 J		15/35	0/23	9	25	-	25	25	-	25	-	-	-25	25	-	-	-25	-	-	-
2535 K		1/5	4/4	10	26	-	26	26	-	26	-	-	-25	26	-	-	27	-	-	-
2598 I		20/26	0/6	16	51	51	51	50	51	51	50	-	-	51	50	-	-50	-51	-51	-
2636 A		26/42	0/16	9	30	-	30	30	-	30	-	-	-30	31	30	30	30	-	-	-
2600 H		25/32	0/11	14	31	-	31	30	-	30	-	-	-30	30	-30	30	30	-	-	-
2612 S		14/17	0/3	10	51	-	51	51	-	51	-	51	-	-	51	51	51	-	-51	-
2663 L		23/27	0/4	13	29	-	29	26	-	28	-	-	-28	29	-	-	-	-	-	-
2523 B		36/42	0/6	12	33	32	32	33	-	33	-	-	-33	32	33	32	33	32	-	-
2550 G		40/43	0/3	13	33	32	32	34	-	33	-	-	-32	33	32	32	32	32	-	-
2574 H		23/32	0/9	14	33	32	33	32	-	33	-	-	-33	32	32	33	33	33	-	-

AVERAGES:

13	33	35	32	32	44	32	51	32	30	31	32	33	35	43	43
NUMBER OF STUDENTS: 15															

REPORT SORTED ACCORDING TO: URGENCY

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TEST	RS	SS	GE	NP	NS	NATIONAL PERCENTILE									
Reading Vocabulary	18	461	5.2	41	5	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx
Reading Comprehension	28	556	7.8	64	6	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx
TOTAL READING	46	518	6.2	55	5	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx
SPELLING	15	530	7.0	62	6	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx
Language Mechanics	21	613	11.8	82	7	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx
Language Expression	21	472	3.4	21	3	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx
TOTAL LANGUAGE	42	525	5.1	44	5	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx
Mathematics Computation	23	436	5.5	43	5	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx
Math Concepts & Applications	29	458	5.7	50	5	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx
TOTAL MATH	52	440	5.6	48	5	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx
REFERENCE SKILLS	8	476	5.8	52	5	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx
TOTAL BATTERY	155	408	2.2	5	2	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx

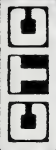
KEY: RS = Raw Score SS = Scale Score GE = Grade Equivalent
 NP = National Percentile NS = National Stanine *** No score available

TEST	RS	SS	GE	NP	NS	PERFORMANCE BY CATEGORY									
READING VOCABULARY						LANGUAGE EXPRESSION									
11 Same Meaning	C					34 Pronouns	C								
12 Compound Word Meaning	C					35 Verbs	C								
13 Affixed Word Meaning	C					36 Adjectives	C								
14 Opposite Meaning	C					37 Subjects/Verbs	C								
15 Multimeaning	C					38 Modifying/Transitional Words	C								
READING COMPREHENSION						39 Complete/Incomplete/Faulty	C								
16 Recall of Facts	C					42 Sequence/Irrelevant Sentence	C								
17 Inferred Meaning	C					MATHEMATICS COMPUTATION									
18 Character Analysis	C					45 Addition	C								
19 Figurative Language	C					46 Subtraction	C								
20 Contextual Analysis	C					47 Multiplication	C								
21 Author Attitude/Position	C					48 Division	C								
SPELLING						MATH CONCEPTS & APPLICATIONS									
23 Consonant Phonemes/Graphemes	C					49 Numeration	C								
24 Vowel Phonemes/Graphemes	C					50 Number Theory	C								
25 Morphemic Units	P					51 Number Properties/Sentences	C								
LANGUAGE MECHANICS						54 Measurement	C								
27 I/Proper Nouns/Adjectives	P					55 Graphs	C								
28 Beginning Words/Titles	P					56 Geometry	C								
29 End Marks	C					57 Problem Solving	C								
31 Comma	C					58 Rounding/Estimation	C								
32 Quotation Marks	P					REFERENCE SKILLS									
						62 Map	C								
						63 Table	C								
						64 Diagram	C								
						65 Dictionary Page	C								
						66 Library Catalogue Cards	C								

KEY: 1 = low; C = competent; P = proficient; N = no score available

For an explanation of this report, please see reverse side

CANADIAN TEST CENTRE



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Code Explanation -----

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- = incorrect answer
= no response
** = score not available

Number of students in group = 14
Reference group (Ref.) is
the national sample of Grade 5.7

D A B U R V G J M T I M S L
A B C C G G J M S S S S W

Average No. Items Right for Objective	Percent Right on Item
Class Ref	Class Ref

READING VOCABULARY

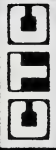
No. of valid sub-test scores: 13

Objective 11 (10 Items)	4.2	6.8	7	3	4	4	5	4	6	4	3	3	5	4	**	2
Same Meaning																
01 fright, scare	92	92	+	+	+	+	+	+	+	+	+	+	+	+	+	+
02 inspect, examine	77	88	+	+	+	+	+	+	+	+	+	+	+	+	+	+
03 nudge, gentle push	8	77	-	-	-	-	-	-	-	-	-	-	-	-	-	-
04 transport, carry	54	74	-	-	-	-	-	-	-	-	-	-	-	-	-	-
05 rarely, seldom	46	66	+	+	+	+	+	+	+	+	+	+	+	+	+	+
06 flee, run away	38	67	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07 scheme, plan	31	63	+	+	+	+	+	+	+	+	+	+	+	+	+	+
08 enormous, immense	15	67	-	-	-	-	-	-	-	-	-	-	-	-	-	-
09 bewildered, confused	46	46	+	+	+	+	+	+	+	+	+	+	+	+	+	+
10 alter, change	8	41	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Objective 12 (5 Items)	1.2	2.8	3	0	1	1	4	1	1	0	1	0	2	0	**	1
Compound Word Meaning																
Computer logged, drrenched	23	70	+	+	+	+	+	+	+	+	+	+	+	+	+	+
12 withdraw, take out	38	76	+	+	+	+	+	+	+	+	+	+	+	+	+	+
13 skylight, calling window	23	35	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14 noteworthy, eye-catching	23	48	+	+	+	+	+	+	+	+	+	+	+	+	+	+
15 underfoot, in the way	8	51	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Objective 13 (5 Items)	1.5	2.8	0	1	3	0	3	0	4	1	0	2	2	**	2	2
Applied Word Meaning																
16 immovable, not able to be moved	54	78	-	+	+	+	+	+	+	+	+	+	+	+	+	+
17 liveable, fit to use	23	59	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18 antisocial, unfriendly	23	46	-	+	+	+	+	+	+	+	+	+	+	+	+	+
19 imperfect, not quite right	38	64	-	+	+	+	+	+	+	+	+	+	+	+	+	+
20 interplanetary, between planets	8	34	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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	Average No. Items Right for Objective	Percent Right on Item	D	A	B	J	N	V	G	U	M	T	I	M	S	L
	Class Ref	Class Ref	4	3	3	1	3	1	4	1	1	0	3	2	**	5
Objective 14 (5 Items)	2.4	3.4														
Opposite Meaning			+	-	-	+	-	+	-	-	-	-	+	+	-	+
21 blind front																
22 bitter sweet																
23 real imaginary			+	+	-	+	-	+	-	+	-	-	-	-	-	+
24 broad narrow			+	+	-	+	-	+	-	+	-	-	-	-	-	+
25 frail strong			+	+	-	+	-	+	-	+	-	-	-	-	-	+
Objective 15 (5 Items)	2.4	3.4														
Objective 15 (5 Items)			2	1	4	1	3	3	5	2	3	0	2	3	**	2
Multimeaning																
26 to slow down brake			+	-	-	+	+	+	+	-	+	-	+	+	-	-
27 a large wading bird crane																
28 overhead surface of room ceiling			-	+	+	+	+	+	+	-	+	-	-	-	-	+
29 a hollow shape mould			+	+	-	+	-	+	-	+	-	-	+	+	-	-
30 not active idle			+	+	-	-	-	-	+	+	-	-	-	-	-	-

CANADIAN TEST CENTRE



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D A B J R V G J M T I M S L

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 ** = score not available

Number of students in group = 14
 Reference group (Ref) is
 the national sample of Grade 5.7

A B C C G G J M M S S S S W

Average No. Items Right for Objective	Class	Ref	Percent Right on Item	Class	Ref
4.8	5.6		62	73	
			92	85	
			62	78	
			46	71	
			31	47	
			92	87	
			77	68	
			23	53	

READING COMPREHENSION

No. of valid sub-test scores: 13

Literal Comprehension

Objective 16 (8 Items)

Recall of Facts

49 Person

31 Thing

36 Event

37 Event

63 Event

35 Place

59 Place

66 Sequence

Interpretive Comprehension

Objective 17 (7 Items)

Inferred Meaning

34 Main Idea

50 Main Idea

65 Main Idea

38 Conclusion

53 Conclusion

62 Cause/Effect

64 Cause/Effect

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D A B U R V G U M T I M S L																		
Average No. Items Right for Objective		Percent Right on Item																
	Class	Ref	Class	Ref	2	1	3	2	4	3	4	1	1	0	1	2	**	2
Objective 18 (6 Items)	2.0	3.3																
Character Analysis																		
54 Feeling			62	72	-	-	+	+	+	+	+	+	-	-	+	+	+	+
67 Feeling			23	47	+	-	-	-	-	-	-	-	-	-	-	-	-	-
61 Trait			23	54	+	-	-	-	-	-	-	-	-	-	-	-	-	-
51 Compare Characters			62	71	+	-	-	-	-	-	-	+	-	-	-	+	+	+
52 Compare Characters			23	48	-	-	-	-	-	-	-	-	-	-	-	-	-	-
58 Compare Characters			8	39	-	-	-	+	-	-	-	-	-	-	-	-	-	-
Objective 19 (7 Items)	3.2	4.2																
Figurative Language					5	4	5	4	6	1	3	2	3	3	3	1	**	2
39 Metaphor			77	84	-	+	+	+	+	-	+	-	+	+	+	+	+	+
40 Metaphor			46	66	+	-	+	+	+	-	-	-	-	-	-	-	-	-
68 Metaphor			54	52	+	+	+	+	+	-	-	-	-	-	-	-	-	-
69 Metaphor			15	48	+	-	-	-	-	-	-	-	-	-	-	-	-	-
41 personification			46	67	+	+	+	+	+	-	-	-	-	-	-	-	-	-
42 personification			77	60	+	+	+	+	+	+	+	+	+	+	+	+	+	+
70 personification			8	38	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Objective 20 (6 Items)	2.6	3.6																
Contextual Analysis					1	2	3	1	3	4	4	3	2	1	3	4	**	3
32 consumes,eats			62	69	-	-	+	+	+	+	+	+	+	-	-	+	+	+
33 savour,taste			69	77	-	-	+	+	+	+	+	+	+	-	-	+	+	+
55 melancholy,sad			38	65	-	-	-	-	-	-	-	-	-	-	-	-	-	-
56 commented,said			8	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-
57 concur,agree			23	35	-	-	-	-	-	-	-	-	-	-	-	-	-	-
60 cumbersome,awkward			62	70	+	-	+	-	-	+	+	+	-	-	+	+	+	+
Critical Comprehension																		
Objective 21 (6 Items)	2.2	3.1																
Author Attitude/Position					4	3	1	4	2	2	5	2	1	0	3	1	**	1
46 Fact			31	44	+	+	-	-	-	-	+	+	-	-	-	-	-	-
43 Fact/Opinion			54	61	-	-	+	+	+	-	+	+	-	-	-	-	-	-
44 Fact/Opinion			38	50	-	-	+	+	+	-	+	+	-	-	-	-	-	-
47 Fact/Opinion			15	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-
45 Viewpoint			46	52	+	+	-	+	-	+	+	-	-	-	-	+	+	+
48 Support of Viewpoint			38	62	+	-	+	+	-	+	+	-	+	-	-	-	-	-

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Code Explanation	D A B C J R V G J M T I M S L												
	A	B	C	C	G	G	J	M	S	S	S	S	W
+ = correct answer - = incorrect answer = no response ** = score not available													
Number of students in group = 14													
Reference group (Ref) is the national sample of Grade 5.7													
SPELLING													
No. of valid sub-test scores:	13												
Average No. Items Right for Objective	Percent Right on Item												
Class Ref	Class Ref												
Objective 23 (6 Items)	4.0 4.0	4	5	6	4	3	5	4	2	3	5	5	2 ** 4
Consonant Phonemes/Graphemes													
01 g/j/ (stranger, stranger)		77	90	+	+	+	+	+	+	+	+	+	-
14 Silent Sgl Ltr (Wednesday)		69	71	+	+	+	+	+	+	+	+	+	+
17 Silent Sgl Ltr (solemn, solemn)		54	46	-	+	+	+	+	+	+	+	+	+
18 Silent Sgl Ltr (crumbs, crumbs)		38	38	-	+	+	+	+	+	+	+	+	+
04 ph/f/ (alphabet, alphabet)		77	81	+	+	+	+	+	+	+	+	+	+
07 nk/nck/ (links, links)		85	74	+	+	+	+	+	+	+	+	+	-
Objective 24 (7 Items)	4.3 4.6	3	3	5	7	5	6	4	2	6	5	4	3 ** 3
Vowel Phonemes/Graphemes													
03 Long e, es/ea (creature, creature)		92	89	+	+	+	+	+	+	+	+	+	+
09 Long o, v-c fnl e (lonely, lonely)		62	71	+	+	+	+	+	+	+	+	+	+
06 Combination au (aukward, awkward)		77	80	+	+	+	+	+	+	+	+	+	+
10 r-control (sugar, sugar)		54	62	-	+	+	+	+	+	+	+	+	+
19 r-control (separate, separate)		23	25	-	+	+	+	+	+	+	+	+	+
16 schwa (general, general)		38	45	-	+	+	+	+	+	+	+	+	+
02 schwa/r-con (furniture, furniture)		85	88	-	+	+	+	+	+	+	+	+	+
Objective 25 (5 Items)	3.4 3.4	0	2	5	3	5	5	5	1	4	5	5	2 ** 2
Morphemic Units													
15 y to i -es (groceries, groceries)		77	61	-	+	+	+	+	+	+	+	+	+
11 f to v -es (calves, calves)		69	70	-	+	+	+	+	+	+	+	+	+
13 final e -ing (exploring, exploring)		62	68	-	+	+	+	+	+	+	+	+	+
08 Add -teen (thirteen, thirteen)		77	77	-	+	+	+	+	+	+	+	+	+
20 Add -teen (eighteen, eighteen)		54	65	-	+	+	+	+	+	+	+	+	+

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	D A B J R V G J M T I M S L											
	Average No. Items Right for Objective		Percent Right on Item		Class		Ref		Class		Ref	
Not an Objective (2 Items)	1.8	1.5	2	2	2	2	2	2	2	2	2	1**
Correct Words												1
OS knit, square			100	83	+	+	+	+	+	+	+	+
12 nephew, freckles			77	66	+	+	+	+	+	+	+	-

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Number of students in group = 14

Reference group (Ref) is the national sample of Grade 5.7

A B C C G G U M M S S S S W

Average No. Items Right for Objective	Percent Right on Item	Class Ref	Class Ref
---------------------------------------	-----------------------	-----------	-----------

LANGUAGE MECHANICS

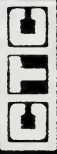
No. of valid sub-test scores: 13

Capitalization	3.2	3.2	4	2	4	4	2	4	1	3	2	4	3	**	4
Objective 27 (4 Items)			+	+	+	+	+	+	+	+	+	+	+	+	+
1/ Proper Nouns/Adjectives															
01 Pronoun I			92	90											+
07 Personal Name			62	72											+
02 Proper Adjective, Geog			92	82											+
04 Proper Adjective, Geog			69	79											+
Objective 28 (5 Items)	1.8	3.0	2	2	3	2	5	3	0	1	1	2	0	**	2
Beginning Words/Titles			+	+	+	+	+	+	+	+	+	+	+	+	-
03 Begin Word, Salutation															-
09 Begin Word, Quotation			54	73											-
05 Title, Movie			31	68											-
08 Title, Song			15	44											+
10 Title, Poem															+
Punctuation	2.4	2.8	2	3	4	4	2	2	1	1	2	3	3	1	**
Objective 29 (4 Items)			+	+	+	+	+	+	+	+	+	+	+	+	+
End Marks															+
11 Period			69	79											+
12 Question Mark			77	83											+
15 Exclamation Point			62	69											+
24 Exclamation Point			31	47											-

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	D A B J R V G U M T I M S																	
	Average No. Items Right for Objective		Percent Right on Item															
	Class	Ref	Class	Ref														
Objective 31 (5 Items)	1.2	2.2			0	1	2	3	3	1	0	2	0	3	0	**	0	
Comma																		
13 Date			46	60	-	-	+	+	+	+	-	+	-	+	-	-	-	
23 Direct Address			23	37	-	+	-	-	-	-	-	+	-	+	-	-	-	
21 Quotation			23	45	-	-	-	-	-	-	-	-	-	-	-	-	-	
25 Series			8	42	-	-	-	-	-	-	-	-	-	-	-	-	-	
19 City/Province			15	36	-	-	-	+	+	-	-	-	-	-	-	-	-	
Objective 32 (5 Items)	3.0	3.5			3	4	4	3	5	4	1	1	4	4	1	**	4	
Quotation Marks																		
14 Undivided			77	72	+	+	+	+	+	+	-	-	+	+	+	+	+	
17 Undivided			46	76	-	+	+	+	+	+	-	-	+	+	-	-	-	
20 Undivided			85	78	+	+	+	+	+	+	-	+	+	+	-	-	-	
22 Divided			23	55	-	-	-	-	-	+	-	-	-	-	-	-	-	
18 Title,Short Work			69	70	+	+	+	+	+	+	-	-	+	+	+	-	+	
Not an Objective (2 Items)	1.5	1.4			1	2	2	2	2	1	1	0	2	2	1	**	2	
Correct Sentences																		
06 No Caps Needed			85	67	+	+	+	+	+	+	-	+	-	+	+	+	+	
16 No Punc Needed			62	70	-	+	+	+	+	+	-	-	-	-	+	+	-	

CANADIAN TEST CENTRE



MCGRAW-HILL RYERSON LIMITED

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	A	B	C	C	G	G	J	M	M	S	S	S	W
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Number of students in group = 14 Reference group (Ref) is the national sample of Grade 5.7													
Average No. Items Right for Objective		Percent Right on Item		Class Ref		Class Ref		Class Ref		Class Ref		Class Ref	
Usage		Objective		3.2		3.5		3.2		3.4		3.7	
Pronouns		Objective 34 (5 Items)		3.2		3.5		3.2		3.4		3.7	
26 Personal Nominative (it)		92		93		92		93		92		93	
27 Personal Objective (them)		69		85		69		85		69		85	
28 Personal Objective (him)		46		82		46		82		46		82	
29 Personal Objective (us)		77		64		77		64		77		64	
30 Personal Objective (me)		31		24		31		24		31		24	
Objective 35 (5 Items)		3.2		3.4		3.2		3.4		3.2		3.4	
Verbs		Objective 36 (5 Items)		2.0		3.7		2.0		3.7		2.0	
31 Tense, Future		62		77		62		77		62		77	
32 Tense, Past Progressive		62		76		62		76		62		76	
33 Tense, Present		85		79		85		79		85		79	
35 Tense, Perfect Infinitive		23		32		23		32		23		32	
34 Agreement		92		78		92		78		92		78	
Objective 36 (5 Items)		3.0		3.2		3.7		3.0		3.2		3.7	
Adjectives		Objective 37 (more important)		38		83		38		83		38	
36 Comparative (chillier)		54		84		54		84		54		84	
38 Comparative (worse)		38		79		38		79		38		79	
40 Comparative (more willing)		38		54		38		54		38		54	
39 Superlative (most cautious)		31		70		31		70		31		70	

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	D A B J R V G U M T I M S L															
	Average No. Items Right for Objective		Percent Right on Item													
	Class	Ref	Class	Ref												
Sentence Structure	2.6	3.5			3	2	6	4	2	1	0	3	3	3	1	**
Objective 37 (6 Items)																
Subjects/Verbs																
47 Subject			69	86	+	+	+	+	+	+	-	+	+	+	+	+
48 Subject			46	46	-	+	+	+	+	-	+	-	-	-	-	+
49 Subject			46	50	-	+	+	+	+	-	-	-	-	-	-	+
50 Verb			23	35	-	+	+	+	-	-	+	+	+	-	-	-
51 Verb			46	57	-	+	+	-	-	-	-	+	+	+	-	-
52 Verb			31	60	+	+	+	-	-	-	-	-	+	+	-	-
Objective 38 (6 Items)	3.7	4.3			2	2	4	4	5	5	6	1	4	4	4	**
Modifying/Transitional Words																
41 Modifier.Adverb			69	81	-	+	+	+	+	+	+	+	+	+	+	+
42 Modifier.Adverb			55	69	-	+	+	+	+	+	+	+	+	+	+	-
43 Modifier.Adverb			54	62	-	+	+	+	+	+	+	+	+	+	+	+
44 Transitional.Connective			54	78	-	+	+	+	+	-	-	+	+	+	+	-
45 Transitional.Connective			59	77	-	+	+	+	+	+	+	+	+	+	+	+
46 Transitional.Connective			58	61	+	-	-	+	+	+	+	-	-	+	+	-
Objective 39 (6 Items)	3.6	3.9			4	4	4	3	3	3	5	1	4	5	4	**
Complete/Incomplete/Faulty																
53 Complete			69	84	+	+	+	+	-	-	-	+	+	+	+	+
54 Complete			54	60	+	+	+	+	+	+	-	+	+	+	+	-
55 Incomplete			92	78	+	+	+	+	+	+	+	+	+	+	+	+
58 Incomplete			92	62	+	+	+	+	+	+	+	+	+	+	+	+
54 Faulty			31	67	-	+	+	-	-	-	-	-	+	+	-	-
57 Faulty			23	44	-	-	-	-	+	-	-	-	-	-	+	-
Paragraph Organization	2.7	3.9			3	4	6	0	1	5	2	0	3	4	4	1
Objective 42 (6 Items)																
Sequence/Irrelevant Sentence																
59 Sentence Sequence			62	89	+	+	+	+	-	+	+	+	+	+	+	-
60 Sentence Sequence			85	72	+	+	+	+	+	+	+	+	+	+	+	+
61 Sentence Sequence			31	58	-	+	-	-	-	+	-	-	+	-	-	+
62 Irrelevant Sentence			58	77	-	+	-	-	-	+	-	-	+	+	-	-
63 Irrelevant Sentence			8	39	-	+	-	-	-	-	-	-	-	-	-	-
64 Irrelevant Sentence			46	61	+	+	+	+	-	+	-	-	+	+	+	-

QUESTION THREE - CASE C

SCHOOL = KEHEWIN
 CLASS = G3 Arithmetic 5-19-88

NO.	NAME	C / T	TO/ER	SE	TE	AV	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
2016 E	33/35	1/2	76	30	32	+	30^2	31	30	*	*	*	*	30	29	-	-	-	-	30	-
2028 A	28/40	1/12	77	28	28	26	28	1	29^2	-	*	*	*	28	28	-	-	-	-	28	-
2030 C	19/25	1/6	71	26	25^2	26	27^1	26^1	-	*	*	*	*	28	28	-	-	-	-	22^08	-
2042 N	17/32	4/15	59	28	28	27	28	27^1	-	*	*	*	*	28	28^1	-	-	-	-	28	-
2055 A	24/30	3/6	16	26	25^1	24	28	26	-	*	*	*	*	28	26^1	-	-	-	-	23	-
2067 K	31/43	0/12	74	28	29	27	12	28^1	29^2	-	*	*	*	29	28^1	-	-	-	-	26^02	-
2079 F	36/43	0/7	57	30	32	29	31	29^2	30	-	*	*	*	31	29	-	-	-	-	29^07	-
2129 K	19/32	0/13	49	27	28	26	26^1	26^1	-	*	*	*	*	27^1	28	-	-	-	-	28^05	-
2131 T	36/45	1/9	76	23	23	21	-	-	-	-	*	*	*	-	26^1	-	-	-	-	22	-
2156 H	26/39	0/13	78	30	31	27	30	31	30^1	-	*	*	*	30	28^3	-	-	-	-	28^03	-
2168 C	33/47	0/14	70	29	28^1	27	12	29	29	-	*	*	*	28^1	28	-	-	-	-	29	-
2170 L	35/44	0/9	74	33	34	+	32	34	32	*	*	*	*	33	31	-	-	-	-	32^02	-
2182 D	22/35	0/13	43	23	25	20^4	-	-	-	-	*	*	*	-	25	-	-	-	-	23^06	-
2194 S	26/40	1/14	74	33	33^1	+	31	34	34	*	*	*	*	34	32	-	-	-	-	30^01	-
2321 D	27/34	1/7	39	28	27	26	30	29	-	*	*	*	*	28	28	-	-	-	-	26	-
2992 C	20/29	4/9	23	26	25	24	28	26	-	*	*	*	*	26	27	-	-	-	-	25	-
3309 F	19/30	3/11	5	5	25	25	25	25	-	-	-	-	-	25	25	-	-	-	-	25	-
3311 R	31/41	2/10	11	11	29	32	+	26	27	-	-	-	-	30	34	-	-	-	-	26	-
3335 W	42/51	0/9	27	25	25	25	26	-	-	*	*	*	*	25	26	-	-	-	-	25^02	-
3754 C	24/36	1/12	37	29	28	27	30	31	-	*	*	*	*	30	29	-	-	-	-	26^04	-
3766 K	31/38	1/7	37	32	31	+	30	31	31^4	-	*	*	*	33	30^1	-	-	-	-	34	-
3830 C	33/41	0/8	12	12	32	31	+	31	38	31	-	-	-	32	31	-	-	-	-	28	-
5999 L	20/36	0/16	27	31	35	+	30^2	31	33	*	*	*	*	32	30^1	-	-	-	-	27^01	-
9771 C	22/31	1/9	35	29	32	28	30	29^1	-	*	*	*	*	30	28^1	-	-	-	-	28^03	-
10684 A	23/31	0/8	10	10	33	35	+	30	34	31	-	-	-	34	36	-	-	-	-	30	-
12548 B	20/26	5/6	12	12	35	33	+	39	29	35	35	-	-	38	36	-	-	-	-	34	-

AVERAGES:

NUMBER OF STUDENTS: 45 10 29 29 26 29 30 32 35 28

REPORT SORTED ACCORDING TO: STUDENT NUMBER

CANADIAN TEST CENTRE



MCGRAW-HILL RYERSON LIMITED

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TEST	RS	SS	GE	NP	NS	NATIONAL PERCENTILE									
Phonic Analysis	5	335	****	3	1	xxxxxxx									
Structural Analysis	4	366	****	7	2	xxxxxxx									
Reading Vocabulary	6	346	2.3	14	3	xxxxxxx									
Reading Comprehension	16	467	3.1	34	4	xxxxxxx									
TOTAL READING	31	390	2.3	14	3	xxxxxxx									
SPELLING	9	355	1.8	7	2	xxxxxxx									
Language Mechanics	6	391	2.0	7	2	xxxxxxx									
Language Expression	14	415	2.2	14	3	xxxxxxx									
TOTAL LANGUAGE	20	398	2.2	8	2	xxxxxxx									
Mathematics Computation	12	326	2.9	11	3	xxxxxxx									
Math Concepts & Applications	18	347	2.5	14	3	xxxxxxx									
TOTAL MATH	30	318	2.6	10	2	xxxxx									
TOTAL BATTERY	90	395	2.3	9	2	xxxxx									

KEY: RS = Raw Score

NP = National Percentile

SS = Scale Score

NS = National Stanine

GE = Grade Equivalent

**** No score available

PERFORMANCE BY CATEGORY OBJECTIVE		NATIONAL PERCENTILE									
PHONIC ANALYSIS		0	1	2	3	4	5	6	7	8	9
03 Consonants/Digraphs	1	----	----	----	----	----	----	----	----	----	----
06 Short, Long Vowels/Vowel Comb	1	----	----	----	----	----	----	----	----	----	----
07 Diphthongs	1	----	----	----	----	----	----	----	----	----	----
08 Variant Vowels/Vowel Comb	1	----	----	----	----	----	----	----	----	----	----
STRUCTURAL ANALYSIS											
09 Comp Wds/Syllables/Contractions	1	----	----	----	----	----	----	----	----	----	----
10 Root Words/Affixes	1	----	----	----	----	----	----	----	----	----	----
READING VOCABULARY											
11 Same Meaning	1	----	----	----	----	----	----	----	----	----	----
14 Opposite Meaning	1	----	----	----	----	----	----	----	----	----	----
15 Multimeaning	1	----	----	----	----	----	----	----	----	----	----
READING COMPREHENSION											
16 Recall of Facts	c	----	----	----	----	----	----	----	----	----	----
17 Inferred Meaning	c	----	----	----	----	----	----	----	----	----	----
18 Character Analysis	c	----	----	----	----	----	----	----	----	----	----
19 Figurative Language	c	----	----	----	----	----	----	----	----	----	----
20 Contextual Meaning	c	----	----	----	----	----	----	----	----	----	----
SPELLING											
23 Consonant Phonemes/Graphemes	1	----	----	----	----	----	----	----	----	----	----
24 Vowel Phonemes/Graphemes	1	----	----	----	----	----	----	----	----	----	----
25 Morphemic Units	1	----	----	----	----	----	----	----	----	----	----
LANGUAGE MECHANICS											
26 I/Proper Nouns	1	----	----	----	----	----	----	----	----	----	----
28 Beginning Words/Titles	1	----	----	----	----	----	----	----	----	----	----
29 End marks	1	----	----	----	----	----	----	----	----	----	----
31 Comma	1	----	----	----	----	----	----	----	----	----	----
LANGUAGE EXPRESSION											
34 Pronouns	p	----	----	----	----	----	----	----	----	----	----
35 Verbs	c	----	----	----	----	----	----	----	----	----	----
36 Adjectives	c	----	----	----	----	----	----	----	----	----	----
31 Subjects/Verbs	c	----	----	----	----	----	----	----	----	----	----
38 Modifying/Transitional Words	c	----	----	----	----	----	----	----	----	----	----
MATHEMATICS COMPUTATION											
45 Addition	1	----	----	----	----	----	----	----	----	----	----
46 Subtraction	1	----	----	----	----	----	----	----	----	----	----
47 Multiplication	1	----	----	----	----	----	----	----	----	----	----
48 Division	1	----	----	----	----	----	----	----	----	----	----
MATH CONCEPTS & APPLICATIONS											
49 Numeration	1	----	----	----	----	----	----	----	----	----	----
50 Number Theory	1	----	----	----	----	----	----	----	----	----	----
51 Number Properties/Sentences	1	----	----	----	----	----	----	----	----	----	----
52 Common Scales	1	----	----	----	----	----	----	----	----	----	----
54 Measurement	1	----	----	----	----	----	----	----	----	----	----
55 Graphs	1	----	----	----	----	----	----	----	----	----	----
56 Geometry	1	----	----	----	----	----	----	----	----	----	----
57 Problem Solving	1	----	----	----	----	----	----	----	----	----	----

KEY: 1 = low; c = competent; p = proficient; n = no score available

For an explanation of this report, please see reverse side

CANADIAN TEST CENTRE



McGraw-Hill Ryerson Limited

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Code Explanation

- + = correct answer
 - = incorrect answer
 * = no response
 ** = score not available

Number of students in group = 23
 Reference group (Ref) is
 the national sample of Grade 3.7

K T C K E D A C C M L N A C K L C F B W A R S

A A B B C U G G G G G U J K M P P P P T W Y Y

Average No. Items Right
 for Objective

Percent Right on Item

Class Ref

MATH CONCEPTS & APPLICATIONS
 No. of valid sub-test scores: 22

Objective 49 (7 Items) 3.7 4.3

Numeration
 01 Ordinal Number, Fourth
 32 44
 34 Rename Thousands + Hundreds + Ones
 36 55
 40 Place Value, Hundreds
 100 88
 06 Expanded Notation, Three-Dig
 5 37
 42 Number Line Sentence, Add
 36 51
 43 Fraction of Group, One-Half
 59 54
 25 Round 3-Dig, Nearest 100

Objective 50 (3 Items) 1.4 1.8

Number Theory
 03 Sequence, Subtract Fives
 14 50
 38 Odd, Even Numbers
 45 47
 41 Factor of 4 and 8

Objective 51 (7 Items) 4.0 3.9

Number Properties/Sentences
 24 Commutative Property, Mult
 59 45
 32 Associative Property, Add
 86 79
 09 Identity Element, Add
 55 61
 29 Identity Element, Mult
 77 68
 16 Div Equation, Solve for Box
 37 Symbol for True Sentence, Mult
 9 33
 17 Greater Than and Less Than
 27 57

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[illegible]

CANADIAN TEST CENTRE



MCGRAW-HILL RYERSON LIMITED

Code Explanation

- + = correct answer
 - = incorrect answer
 * = no response
 ** = score not available

Number of students in group = 23
 Reference group (Ref) is
 the national sample of Grade 3.7

K T C K E D A C M L N A C K L C F B W A R S

A A B B C D G G G J J K M P P P P T W Y Y

Average No. Items Right
 for Objective
 Percent
 Item

Class Ref
 Ciss Ref

MATHEMATICS COMPUTATION

No. of valid sub-test scores: 23

5.4 6.3

Objective 45 (9 Items)

- Addition-Dig + One-Dig, Horiz
 01 Two-Dig - One-Dig
 12 Two-Dig - One-Dig
 13 Two-Dig - One-Dig
 14 Two-Dig - One-Dig
 15 Two-Dig - One-Dig
 16 Two-Dig + 2 One-Dig
 17 Two-Dig - One-Dig
 18 Two-Dig - One-Dig
 19 Two-Dig - One-Dig
 20 Two-Dig - One-Dig
 21 Two-Dig - One-Dig
 22 Two-Dig - One-Dig
 23 Two-Dig - One-Dig
 24 Two-Dig - One-Dig
 25 Two-Dig - One-Dig
 26 Two-Dig - One-Dig
 27 Two-Dig - One-Dig
 28 Two-Dig - One-Dig
 29 Two-Dig - One-Dig
 30 Two-Dig - One-Dig
 31 Two-Dig - One-Dig
 32 Two-Dig - One-Dig
 33 Two-Dig - One-Dig
 34 Two-Dig - One-Dig
 35 Two-Dig - One-Dig
 36 Two-Dig - One-Dig
 37 Two-Dig - One-Dig
 38 Two-Dig - One-Dig
 39 Two-Dig - One-Dig
 40 Two-Dig - One-Dig
 41 Two-Dig - One-Dig
 42 Two-Dig - One-Dig
 43 Two-Dig - One-Dig
 44 Two-Dig - One-Dig
 45 Two-Dig - One-Dig
 46 Two-Dig - One-Dig
 47 Two-Dig - One-Dig
 48 Two-Dig - One-Dig
 49 Two-Dig - One-Dig
 50 Two-Dig - One-Dig
 51 Two-Dig - One-Dig
 52 Two-Dig - One-Dig
 53 Two-Dig - One-Dig
 54 Two-Dig - One-Dig
 55 Two-Dig - One-Dig
 56 Two-Dig - One-Dig
 57 Two-Dig - One-Dig
 58 Two-Dig - One-Dig
 59 Two-Dig - One-Dig
 60 Two-Dig - One-Dig
 61 Two-Dig - One-Dig
 62 Two-Dig - One-Dig
 63 Two-Dig - One-Dig
 64 Two-Dig - One-Dig
 65 Two-Dig - One-Dig
 66 Two-Dig - One-Dig
 67 Two-Dig - One-Dig
 68 Two-Dig - One-Dig
 69 Two-Dig - One-Dig
 70 Two-Dig - One-Dig
 71 Two-Dig - One-Dig
 72 Two-Dig - One-Dig
 73 Two-Dig - One-Dig
 74 Two-Dig - One-Dig
 75 Two-Dig - One-Dig
 76 Two-Dig - One-Dig
 77 Two-Dig - One-Dig
 78 Two-Dig - One-Dig
 79 Two-Dig - One-Dig
 80 Two-Dig - One-Dig
 81 Two-Dig - One-Dig
 82 Two-Dig - One-Dig
 83 Two-Dig - One-Dig
 84 Two-Dig - One-Dig
 85 Two-Dig - One-Dig
 86 Two-Dig - One-Dig
 87 Two-Dig - One-Dig
 88 Two-Dig - One-Dig
 89 Two-Dig - One-Dig
 90 Two-Dig - One-Dig
 91 Two-Dig - One-Dig
 92 Two-Dig - One-Dig
 93 Two-Dig - One-Dig
 94 Two-Dig - One-Dig
 95 Two-Dig - One-Dig
 96 Two-Dig - One-Dig
 97 Two-Dig - One-Dig
 98 Two-Dig - One-Dig
 99 Two-Dig - One-Dig
 100 Two-Dig - One-Dig

5.8 6.1

Objective 46 (10 Items)

- Subtraction
 01 Basic Fact Two-Dig - One-Dig
 02 Basic Fact Two-Dig - One-Dig
 03 Basic Fact Two-Dig - One-Dig
 04 Basic Fact Two-Dig - One-Dig
 05 Basic Fact Two-Dig - One-Dig
 06 Basic Fact Two-Dig - One-Dig
 07 Basic Fact Two-Dig - One-Dig
 08 Basic Fact Two-Dig - One-Dig
 09 Basic Fact Two-Dig - One-Dig
 10 Basic Fact Two-Dig - One-Dig
 11 Basic Fact Two-Dig - One-Dig
 12 Basic Fact Two-Dig - One-Dig
 13 Basic Fact Two-Dig - One-Dig
 14 Basic Fact Two-Dig - One-Dig
 15 Basic Fact Two-Dig - One-Dig
 16 Basic Fact Two-Dig - One-Dig
 17 Basic Fact Two-Dig - One-Dig
 18 Basic Fact Two-Dig - One-Dig
 19 Basic Fact Two-Dig - One-Dig
 20 Basic Fact Two-Dig - One-Dig
 21 Basic Fact Two-Dig - One-Dig
 22 Basic Fact Two-Dig - One-Dig
 23 Basic Fact Two-Dig - One-Dig
 24 Basic Fact Two-Dig - One-Dig
 25 Basic Fact Two-Dig - One-Dig
 26 Basic Fact Two-Dig - One-Dig
 27 Basic Fact Two-Dig - One-Dig
 28 Basic Fact Two-Dig - One-Dig
 29 Basic Fact Two-Dig - One-Dig
 30 Basic Fact Two-Dig - One-Dig
 31 Basic Fact Two-Dig - One-Dig
 32 Basic Fact Two-Dig - One-Dig
 33 Basic Fact Two-Dig - One-Dig
 34 Basic Fact Two-Dig - One-Dig
 35 Basic Fact Two-Dig - One-Dig
 36 Basic Fact Two-Dig - One-Dig
 37 Basic Fact Two-Dig - One-Dig
 38 Basic Fact Two-Dig - One-Dig
 39 Basic Fact Two-Dig - One-Dig
 40 Basic Fact Two-Dig - One-Dig
 41 Basic Fact Two-Dig - One-Dig
 42 Basic Fact Two-Dig - One-Dig
 43 Basic Fact Two-Dig - One-Dig
 44 Basic Fact Two-Dig - One-Dig
 45 Basic Fact Two-Dig - One-Dig
 46 Basic Fact Two-Dig - One-Dig
 47 Basic Fact Two-Dig - One-Dig
 48 Basic Fact Two-Dig - One-Dig
 49 Basic Fact Two-Dig - One-Dig
 50 Basic Fact Two-Dig - One-Dig
 51 Basic Fact Two-Dig - One-Dig
 52 Basic Fact Two-Dig - One-Dig
 53 Basic Fact Two-Dig - One-Dig
 54 Basic Fact Two-Dig - One-Dig
 55 Basic Fact Two-Dig - One-Dig
 56 Basic Fact Two-Dig - One-Dig
 57 Basic Fact Two-Dig - One-Dig
 58 Basic Fact Two-Dig - One-Dig
 59 Basic Fact Two-Dig - One-Dig
 60 Basic Fact Two-Dig - One-Dig
 61 Basic Fact Two-Dig - One-Dig
 62 Basic Fact Two-Dig - One-Dig
 63 Basic Fact Two-Dig - One-Dig
 64 Basic Fact Two-Dig - One-Dig
 65 Basic Fact Two-Dig - One-Dig
 66 Basic Fact Two-Dig - One-Dig
 67 Basic Fact Two-Dig - One-Dig
 68 Basic Fact Two-Dig - One-Dig
 69 Basic Fact Two-Dig - One-Dig
 70 Basic Fact Two-Dig - One-Dig
 71 Basic Fact Two-Dig - One-Dig
 72 Basic Fact Two-Dig - One-Dig
 73 Basic Fact Two-Dig - One-Dig
 74 Basic Fact Two-Dig - One-Dig
 75 Basic Fact Two-Dig - One-Dig
 76 Basic Fact Two-Dig - One-Dig
 77 Basic Fact Two-Dig - One-Dig
 78 Basic Fact Two-Dig - One-Dig
 79 Basic Fact Two-Dig - One-Dig
 80 Basic Fact Two-Dig - One-Dig
 81 Basic Fact Two-Dig - One-Dig
 82 Basic Fact Two-Dig - One-Dig
 83 Basic Fact Two-Dig - One-Dig
 84 Basic Fact Two-Dig - One-Dig
 85 Basic Fact Two-Dig - One-Dig
 86 Basic Fact Two-Dig - One-Dig
 87 Basic Fact Two-Dig - One-Dig
 88 Basic Fact Two-Dig - One-Dig
 89 Basic Fact Two-Dig - One-Dig
 90 Basic Fact Two-Dig - One-Dig
 91 Basic Fact Two-Dig - One-Dig
 92 Basic Fact Two-Dig - One-Dig
 93 Basic Fact Two-Dig - One-Dig
 94 Basic Fact Two-Dig - One-Dig
 95 Basic Fact Two-Dig - One-Dig
 96 Basic Fact Two-Dig - One-Dig
 97 Basic Fact Two-Dig - One-Dig
 98 Basic Fact Two-Dig - One-Dig
 99 Basic Fact Two-Dig - One-Dig
 100 Basic Fact Two-Dig - One-Dig

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Average No. Items Right for Objective		K T C K E D A C B C M L N A C K L C F B W A R S																											
Class	Ref	Class	Ref																										
4.3 5.8																													
Objective 47 (10 Items)																													
Multiplication																													
07 Basic Fact.2 One-Dig	43 74	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		
24 Basic Fact.2 One-Dig	22 47	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		
04 Basic Fact.10 x One-Dig	70 89	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		
05 Mult of 10 x One-Dig	13 43	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		
22 Two-Dig x One-Dig, Horiz	43 51	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		
22 Two-Dig x One-Dig, No Regr	35 53	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		
23 Two-Dig x One-Dig, No Regr	17 38	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		
21 Two-Dig x One-Dig	78 79	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		
06 Three-Dig x Zero, Horiz	78 81	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		
08 Three-Dig x Zero	35 29	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		
38 Three-Dig x One-Dig, No Regr																													
4.8 5.9																													
Objective 48 (10 Items)																													
Division																													
09 Basic Fact.2 One-Dig	74 79	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		
10 Basic Fact.2 One-Dig	51 80	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
27 Basic Fact.2 One-Dig	22 41	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
11 Basic Fact. Two-Dig + One-Dig	70 72	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		
12 Basic Fact. Two-Dig + One-Dig	70 64	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		
25 Basic Fact. Two-Dig + One-Dig	74 70	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		
26 Basic Fact. Two-Dig + One-Dig	30 52	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		
28 Basic Fact. Two-Dig + One-Dig	30 51	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
39 Basic Fact. Two-Dig + One-Dig	17 44	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		
40 Mult of 10 + One-Dig	30 40	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		

QUESTION NINE - CASE D

SCHOOL = SADDLE LAKE
CLASS = 194 Arithmetic

NO.	NAME	C/T	10/ER	SE	TE	AV	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
6282 J		47/63	1/16	>	14	14	14	14	-	-	-	-	-	-	-	-	-	-	-	-	-
6205 B		46/66	2/20	>	14	16	19	2	13	1	-	-	-	-	-	-	-	-	-	-	-
6217 E		22/39	3/17	>	15	16	24	13	-	-	-	-	-	-	-	-	-	-	-	-	-
6318 B		38/60	0/22	>	15	20	25	18	7	-	-	-	-	-	28	-	-	-	-	21	-
6320 C		42/64	0/22	>	10	10	12	12	12	-	-	-	-	-	-	-	-	-	-	-	-
6243 D		16/50	0/34	>	3	3	13	13	13	-	-	-	-	-	-	-	-	-	-	-	-
6332 C		47/31	2/14	>	10	10	18	20	16	-	-	-	-	-	17	-	-	-	-	-	-
6256 E		20/33	1/13	>	12	12	20	24	16	-	-	-	-	-	21	-	-	-	-	20	-
6294 S		37/42	0/5	>	13	21	24	19	-	-	-	-	-	-	22	-	-	-	-	26	-
6268 J		26/40	0/14	>	9	9	23	25	25	-	-	-	-	-	20	-	-	-	-	20	-
6306 C		20/29	3/9	>	9	9	27	28	26	27	26	-	-	-	26	27	-	-	-	29	-
6229 L		40/47	1/7	>	6	6	51	51	+	+	+	51	51	51	51	51	51	51	51	51	51
AVERAGES:																					
NUMBER OF STUDENTS:																					
REPORT SORTED ACCORDING TO: URGENCY																					

11 8 21 23 17 27 26

12

51 51 38 27 51 51 51 51 28 51

CANADIAN TEST CENTRE



MCGRAW-HILL RYERSON LIMITED

TEST	RS	SS	GE	NP	NS	NATIONAL PERCENTILE									
Phonic Analysis	15	398	***	***	***										
Structural Analysis	5	364	***	***	***										
Reading Vocabulary	8	354	2.4	4	1	xxxxxx									
Reading Comprehension	17	472	3.2	18	3	xxxxxx									
TOTAL READING	45	404	2.5	7	2	xxxxxx									
SPELLING	11	370	2.1	4	1	xxxxxx									
Language Mechanics	8	381	1.8	3	1	xxxxxx									
Language Expression	13	411	2.2	5	2	xxxxxx									
TOTAL LANGUAGE	21	388	2.0	2	1	xxxxxx									
Mathematics Computation	12	296	2.3	1	1	xxxxxx									
Math Concepts & Applications	9	243	0.6	1	1	xxxxxx									
TOTAL MATH	21	252	1.5	1	1	xxxxxx									
TOTAL BATTERY	98	322	2.1	1	1	xxxxxx									

KEY: RS = Raw Score

NP = National Percentile

SS = Scale Score

NS = National Stanine

GE = Grade Equivalent

*** No score available

		PERFORMANCE BY CATEGORY OBJECTIVE									
		MATHEMATICS COMPUTATION									
PHONIC ANALYSIS											
01 Variant Single Consonants	c	---	0	---	---	0	---	---	---	0	---
02 Consonant Clusters/Digraphs	c	---	0	---	---	0	---	---	---	0	---
03 Consonant Vowels/Vowel Comb	c	---	0	---	---	0	---	---	---	0	---
04 Short Vowels/Vowel Comb	c	---	0	---	---	0	---	---	---	0	---
05 Long Vowels/Vowel Comb	c	---	0	---	---	0	---	---	---	0	---
STRUCTURAL ANALYSIS											
09 Comp Wds/Syllables/Contractions	c	---	0	---	---	0	---	---	---	0	---
10 Root Words/Affixes	c	---	0	---	---	0	---	---	---	0	---
READING VOCABULARY											
11 Same Meaning	c	---	0	---	---	0	---	---	---	0	---
14 Opposite Meaning	c	---	0	---	---	0	---	---	---	0	---
READING COMPREHENSION											
16 Recall of Facts	p	---	0	---	---	0	---	---	---	0	---
17 Inferred Meaning	p	---	0	---	---	0	---	---	---	0	---
18 Character Analysis	p	---	0	---	---	0	---	---	---	0	---
SPELLING											
23 Consonant Phonemes/Graphemes	c	---	0	---	---	0	---	---	---	0	---
24 Vowel Phonemes/Graphemes	c	---	0	---	---	0	---	---	---	0	---
25 Morphemic Units	c	---	0	---	---	0	---	---	---	0	---
LANGUAGE MECHANICS											
26 I/Proper Nouns	c	---	0	---	---	0	---	---	---	0	---
28 Beginning Words/Titles	c	---	0	---	---	0	---	---	---	0	---
29 End Marks	c	---	0	---	---	0	---	---	---	0	---
31 Commas	c	---	0	---	---	0	---	---	---	0	---
LANGUAGE EXPRESSION											
33 Irregular Nouns/Verbs	c	---	0	---	---	0	---	---	---	0	---
34 Pronouns	c	---	0	---	---	0	---	---	---	0	---
35 Verbs	c	---	0	---	---	0	---	---	---	0	---
36 Adjectives	c	---	0	---	---	0	---	---	---	0	---

KEY: 1 = low; c = competent; p = proficient; n = no score available

For an explanation of this report, please see reverse side

CANADIAN TEST CENTRE



MCGRAW-HILL RYERSON LIMITED

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Code Explanation	E	C	U	B
+ = correct answer				
- = incorrect answer				
* = no response				
** = score not available				
Number of students in group = 4				
Reference group (Ref) is				
the national sample of Grade 2.7				
	C	D	L	W

Average No. Items Right for Objective	Class	Ref	Percent Right on Item	Class	Ref

MATHEMATICS COMPUTATION

No. of valid sub-test scores: 4

Objective	45 (10 Items)	5.0	6.6	4	3	8	5
Addition							
06 3 One-Dig. Horiz			25	81			
03 4 One-Dig. Horiz			50	82			
08 Two-Dig + 2 One-Dig. Horiz			25	58			
01 2 Two-Dig. No Regr			100	93			
04 2 Two-Dig. No Regr			100	90			
07 2 Two-Dig			25	54			
10 2 Two-Dig + 2 One-Dig			25	23			
05 4 Two-Dig. No Regr			25	74			
02 2 Three-Dig. No Regr			100	80			
09 Three-Dig + Two-Dig			25	28			
Objective 46 (10 Items)	4.5	6.2	6	5	1	6	
Subtraction							
14 2 Two-Dig. Horiz. No Regr			75	66			
18 2 Two-Dig. Horiz. No Regr			0	55			
20 2 Two-Dig. Horiz. No Regr			0	45			
11 2 Two-Dig. No Regr			75	80			
13 2 Two-Dig. No Regr			0	57			
16 Mult of 10 - One-Dig. Horiz			0	57			
17 Three-Dig - Two-Dig. No Regr			75	62			
19 Three-Dig - Mult of 10. No Regr			75	51			
12 2 Mult of 100			75	78			
15 2 Three-Dig. No Regr			75	68			

... continued on back of sheet

E C U B

	Average No. Items Right for Objective		Percent Right on Item	
	Class	Ref	Class	Ref
Objective 47 (6 Items)	3.3	3.4	1	5 3 4
Multiplication				
21 Basic Fact.2 One-Dig			75	62 - + +
22 Basic Fact.2 One-Dig			50	63 - + -
23 Basic Fact.2 One-Dig			25	57 - + -
24 Basic Fact.2 One-Dig			75	54 - + +
25 10 x One-Dig, Horiz			100	58 + + +
26 Two-Dig x One-Dig, Horiz, No Regr			0	49 - - -

	E C U B			
	Average No. Items Right for Objective		Percent Right on Item	
	Class	Ref	Class	Ref
Objective 52 (6 Items)	2.8	4.2	2	3 2 4
Common Scales				
15 Read Clock, Half Hour			100	84
03 Money, Story Problem, Value of Coins			25	60
13 Money, Story Problem, Change			25	62
17 Read Calendar, Date on Day			50	52
18 Read Calendar, No. of Fridays			25	80
23 Dozen, Meaning			50	79
Objective 53 (7 Items)	3.0	5.4	1	3 3 5
Measurement/Graphs				
32 Story Problem, Ruler, Add Units			25	78
07 Story Problem, Add L			25	81
09 Least Weight or Mass, g			25	75
34 Picture Graph, Read			50	83
35 Picture Graph, Subt			0	58
20 Bar Graph, Read			75	86
21 Bar Graph, Read			100	80
Objective 56 (5 Items)	2.0	3.7	2	1 2 3
Geometry				
12 Plane Shape, Triangle			50	92
28 Plane Shape, Squares			25	87
16 Same Shape, Pentagon			25	86
26 Shape Family, 4 Sides			50	53
31 Same Figure, Angle			50	51

APPENDIX C

**EVALUATION REPORT
DEGEM, TOAM SYSTEM
KEHEWIN AND SADDLE LAKE, ALBERTA**

**EVALUATION REPORT
DEGEM - TOAM COMPUTER SYSTEM
Kehewin and Saddle Lake, Alberta**

**CURRICULUM SUPPORT BRANCH
ALBERTA EDUCATION
OCTOBER, 1989**

EVALUATION REPORT

DEGEM - TOAM COMPUTER SYSTEM

Kehewin and Saddle Lake

PROGRAM DESCRIPTION

The DEGEM - TOAM is an integrated system made up of a forty megabyte miniframe computer, a 20 megabyte tape backup, 24 to 26 terminals with detachable keyboards and a printer. The accompanying TOAM courseware is a testing and drill and practice system intended to provide pupils with the opportunity to practice extensively at their own level and pace. The drill and practice is accompanied by reports for the teacher which indicate the strengths and weaknesses of the students. These results are then used by the system to determine the level of the exercises to be presented to the student.

The two curriculum areas under review for this evaluation are Arithmetic and English. Each subject area drills basic skills and is divided into topics which are organized according to levels. The arithmetic program, divided into fifteen topics, start at the beginning of Grade 1 and continues to the end of Grade 7, i.e. level 10 to 79. The arithmetic topics covered are:

1. numerical systems,
2. addition and subtraction up to 20,
3. vertical addition,
4. vertical subtraction,
5. multiplication and division up to 100,
6. vertical multiplication,
7. long division,
8. mental arithmetic,
9. equations and laws of arithmetic,
10. measurements,
11. simple fractions,
12. decimals and percentages,
13. negative numbers,
14. word problems, and
15. divisibility, factoring and powers.

The English program is divided into fifteen topics which starts at the beginning of Grade 2 and continues to the end of Grade 6. (The ESL program is divided into ten topics, starts in Grade 4 and continues to the end of Grade 7. A separate Reading Comprehension module exists but is NOT part of this evaluation.) The topics covered in the English program are:

1. letter/word attack, dictionary skills, abbreviations;
2. vocabulary;
3. pronouns, noun endings, noun compounds, reference;
4. modals/auxiliaries, sentence patterns;
5. verb forms;
6. prefixes and suffixes;
7. adjectives and adverbs;
8. noun phrases, prepositions, phrasal verbs;
9. sentence patterns, evaluative reading;
10. verb usage, detailed information;
11. coordination, reference;
12. punctuation, classification, context clues;
13. details and main ideas;
14. sequence; and
15. cause and effect, conclusions, inferences.

The TOAM educational approach contains four main components:

- pre-testing,
- drill and practice,
- records of pupil achievement for the teacher, and
- post-testing.

The first stage, the pre-testing stage, takes approximately twelve lessons. The system begins at a fairly low level and then raises or lowers the level of the exercises so as to determine the level at which the student successfully solves two thirds of the problems on the first try. After the starting level for each of the topics has been determined, the drill begins.

The drill and practice section of the program has students involved in working on a variety of types of exercises such as fill in the blank, multiple choice and completing the answer. Some graphics are used for illustration. Questions are selected randomly from a large data bank of questions within each level. Students are given three chances to answer each question. After five questions on a topic at a level, the results are evaluated and if successful, the student is advanced to the next level for that topic. The competency level which must be achieved is still two-thirds correct on the first try. If unsuccessful, the student is presented with another group of five questions at the same level of difficulty or may be dropped down a level. Results from each topic are recorded separately.

The record keeping system is for the teacher and individual student or class reports may be printed when required. The reports inform the teacher as to the last lesson completed, the level attained, the number of questions attempted, the number correct on the first try, the number of errors, the average for the levels, those that caused difficulties, the levels which were used for the diagnostic pre-test and the starting level for the drill and practice for each topic for each student. These reports are to help the teacher isolate any specific difficulties so s/he can attend to them immediately.

The post-testing involves a repeat testing at the end of the school year, of the same criteria as were used in the pre-testing phase, in order to compare the new level of achievement.

Before the students can begin using the system, the teacher must assign each one with an identification number. This unique number must then be entered by the student for each new session, in order to access his/her work assignment, even if two sessions are done at the same sitting. The student should retain the same identification number each year in that school.

The support documentation provided by DEGEN Systems Ltd. includes: Pedagogical Principles Underlying the TOAM System (9 pages), The DEGEN System General Instructions for the User (5 pages), Mathematics/Arithmetic Teacher's Manual 1987 (11 pages), TOAM 2A Arithmetic Teacher's Guide (28 pages), Mathematics/Arithmetic Exercise Summary 1987 (91 pages), English Course Teacher's Manual 1987 (18 pages), TOAM 2A English as a Second/Foreign Language Teacher's Guide (11 pages), and English Exercise description 1987 (169 pages).

PROGRAM EVALUATION

In-depth Instructional Design and Tolerance and Understanding analyses for these materials would be very time consuming and demand approximately six weeks on-site; therefore analyses were not conducted. The following Instructional Design evaluations are based on observations from spending a limited amount of time on-site on the system and from comments at the committee meetings by the teachers responsible for the systems in Saddle Lake and Kehewin. There is also no assurance that the specific grade levels targeted by DEGEN Systems Ltd. for concepts in fact correspond to the levels specified by Alberta Education as a Curriculum Fit has not been done on the materials.

The Language Arts content is very sub-skill oriented for drill and practice applications which should only complement or supplement the use of the department advocated wholistic approach for teaching Language Arts. Nonetheless, from a remedial point of view, the sub-skill orientation may have some merit.

The systems major strength, when it is used properly, is its diagnostic tool capability. Another strength includes the fact that the system can be expanded, by a highly knowledgeable computer teacher, to accomplish tasks for which it is not currently programmed. For example, in Saddle Lake, the system was expanded so that the terminals with keyboards could be used to teach keyboarding and rudimentary word processing skills. The system, in proper hands, could become a flexible tool to help students; however, likely few teachers with the level of expertise required would be available to oversee one of these systems.

With this system of computers, keyboards are detachable and therefore optional. The schools (at least in Saddle Lake) do not have enough keyboards for all of the computer terminals. The Arithmetic and English courseware, prepared at Stanford University and modified in Israel, is programmed to accommodate the fact that keyboards are optional hardware. Therefore, although the students are actively involved in the lesson, the responses generally involve pressing a numbered key (0 to 9) and occasionally one of the keys on the right side of the monitor. This selection of keys may be appropriate for most of the inputs required for Arithmetic; however, in Language Arts, it is questionable as to the kind and amount of learning which can be accomplished by pressing a few number keys.

According to DEGEM Systems Ltd., approximately three ten-minute sessions a week is enough for the students to benefit from the courseware. As these computers are located in a computer room, the students must leave their classroom to go to this room, log onto the system, do their ten-minute session and return to the classroom. The entire process, while observing a Grade One and a Grade Four, each class took about 15 to 30 minutes. This results in a significant amount of time off-task for the potential benefits of a ten-minute session.

The depth of practice per session varies from student to student as the student controls the program's pace by providing a response. Some students may cover very little content during one session and others may complete many exercises.

Questions are effectively randomized and because of the size of the data banks, students are not likely to be presented with the exact question twice in a session unless they have incorrectly answered the question earlier. Immediate textual feedback with limited low resolution graphics are included. Positive feedback for correct answers on the first try include "Excellent" and "Very Good". Satisfactory quantitative feedback is provided at the end of a session and indicates to the student the number of questions attempted, the number answered correctly on the first try and the number correct on the second or third attempt. Although three attempts are allowed per question, only when the first attempt is correct is the answer counted as correct. If the correct answer is not provided by the third try, the program merely supplies it. Unfortunately, if the student accidentally presses a wrong key, the input is automatically considered as a wrong answer. The criteria used for making students back up is based on two factors: not achieving the cut off percentage on a set and having a number of consecutively incorrect answers. Although identification numbers are assigned, one could deliberately access someone else's work by entering a code similar to their own. The person's name appears on the monitor and the student simply presses the green arrow key to proceed. This is especially true if all of the identification numbers are assigned sequentially.

Some of the content has been incorrectly programmed, with parts of sections and even entire sections providing inaccurate answers. This is detrimental to the student who is certain s/he is providing the correct answer, yet it is considered wrong by the program. As a result, in one school, the sections found containing errors have been locked out so they will not be presented to the students. In the other school, the errors found have been reprogrammed accurately and questions have been altered to make them more relevant

to this user group. At times, the system erroneously presents system text written in Hebrew. The levels of password security in the system seem inappropriate as students, by "playing" around could possibly access some of the main command screens. This is most unfortunate as an inquisitive student could sabotage the system.

A very high level of technical expertise and system familiarity as well as a significant amount of time is required from the person(s) in charge of this system. In order for the system to succeed, it relies heavily on adequate in-servicing for the teachers involved. In-servicing places demands on staff time and therefore a cost factor is also directly or indirectly associated. Furthermore, there is no way in which one can ensure that the in-services will in fact take place.

The teacher documentation included with the system is minimal although the English Exercise Description and Mathematics/Arithmetic Exercise Summary provide the teacher with satisfactory descriptions of the types of questions presented at the specific levels. Unfortunately, not all of the documentation contains page numbers for easy reference.

From a technical perspective, the initial hardware costs were very substantial, approximately \$315,000.00 for two sites. This is further compounded by the \$12,000.00 per site annual fee required for the maintenance contract. Since the DEGEM Systems Ltd. offices are located in Florida, it is impossible to have servicemen respond quickly to local problems. The manuals included with the system are of very poor quality, lacking much of the crucial trouble shooting information needed and even some of the simple technical operational information which could assist the responsible teachers on-site to pinpoint and to correct the problems. As a result, the systems are sometimes faced with extended periods of "downtime" when the system is not functioning. One of the "downtimes" in Saddle Lake resulted from a simple burned out fuse; however, the problem was not identified until a couple weeks later and much hard work on the part of the computer specialist. It is unacceptable that such poor quality documentation would accompany such a complex miniframe system. Other technical drawbacks include occasional overheating in some of the terminals. This can be remedied to some extent by removing one of the panels on the computer, thus allowing more air circulation. The most detrimental problem with this courseware is that it operates on an antiquated modified PDP-11 system.

To recapitulate, this system's main strength lies in its diagnostic capabilities; its possibility for expanded use by a computer specialist to provide students with the added opportunity to learn keyboarding and word processing skills; its record keeping/management system which provides the teacher with diagnostic information; and somewhat individualized drill and practice sessions to meet the needs of the students. However, in view of the considerable initial costs for the outdated hardware, the unrealistic maintenance fee yet unreliable service provided by Florida-based personnel, the instructional design flaws in the courseware identified above, the DEGEM - TOAM educational system does not meet our standards.

Evaluator: Alberta Education Evaluation Team

Date: October 1989

Name:

J. Talone

REFERENCES:

The DEGEM System General Instructions for the User by DEGEM Systems LTD.

English Course Teacher's Manual 1987 by DEGEM Systems LTD.

English Exercise Description 1987 by DEGEM Systems LTD.

Mathematics/Arithmetic Exercise Summary 1987 by DEGEM Systems LTD.

Mathematics/Arithmetic Teacher's Manual 1987 by DEGEM Systems LTD.

Pedagogical Principles Underlying the Toam System by DEGEM Systems LTD.

TOAM-2A Arithmetic Teacher's Guide by DEGEM Systems

Clearinghouse Evaluators' Guide for Microcomputer-Based Courseware

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